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Introduction

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Introduction

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Volume 7 Number 10 / May 23, 1969

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **1615**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1618**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **1623**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **1628**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **1636**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **1639**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **1656**

08 COMPUTERS
Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **1662**

09 ELECTRONIC EQUIPMENT
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. **1669**

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. **1674**

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. **1678**

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **1680**

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. **1689**

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. **1703**

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, reliability; drafting; and materials fabrication, handling, and inspection. **1708**

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. **1714**

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see : 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. **1715**

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **1723**

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. **1726**

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 1736

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 1739

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 1742

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 1744

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 1749

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 1757

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 1761

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 1767

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 1767

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 1771

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 1771

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **1780**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **1784**

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **1791**

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. **1796**

SUBJECT INDEX I-1

PERSONAL AUTHOR INDEX I-65

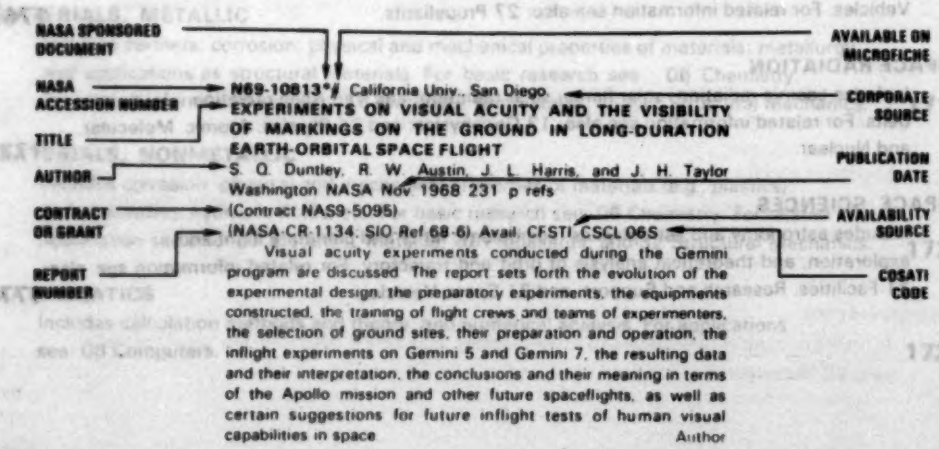
CORPORATE SOURCE INDEX I-93

CONTRACT NUMBER INDEX I-111

REPORT/ACCESSION NUMBER INDEX I-117

ACCESSION/REPORT NUMBER INDEX I-129

TYPICAL CITATION AND ABSTRACT FROM *STAR*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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov 1968 231 p refs
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(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
REPORT NUMBER
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-20861# RAND Corp., Santa Monica, Calif.
HYPERSONIC STRONG INTERACTION SIMILARITY SOLUTIONS FOR FLOW PAST A VERY SLENDER AXISYMMETRIC BODY
W. B. Bush Dec. 1968 46 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-681378; RM-5699-ARPA) Avail: CFSTI CSCL 16/4

The Navier-Stokes hypersonic strong-interaction theory is presented for the flow of a viscous, heat-conducting, compressible fluid past a very slender axisymmetric body, when the ratio of the radius of the body to the radial thickness of the viscous layer(s) (which the body produces and supports), goes to zero. The self-similar leading approximations for the behavior of the flow in these four regions are analyzed, and it is found that an arbitrary body supports 3/4-power viscous and shock layers. Author (TAB)

N69-20873*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
WIND-TUNNEL FORCE AND PRESSURE TESTS OF ROCKET-ENGINE NOZZLE EXTENSIONS ON THE 0.0667-Scale X-15-2 MODEL AT SUPERSONIC AND HYPERSONIC SPEEDS
Earl J. Montoya and Jack Nugent Washington Mar. 1969 65 p refs
(NASA-TM-X-1759) Avail: CFSTI CSCL 01A

Wind-tunnel force and pressure test results of nozzle extensions on the 0.0667-scale X-15-2 model over the free-stream Mach number range from 2.3 to 8.0 at angles of attack from −5° to 18° and Reynolds numbers of 2.0×10^6 per foot (6.56×10^6 per meter) and 3.4×10^6 per foot (1.12×10^7 per meter) are presented. The effects of the presence of an aft-mounted ramjet shape and control-surface deflections are shown. Force data indicate that the addition of the nozzle extensions did not appreciably affect the overall drag or static margin of the model. On the basis of these results as well as other considerations, a nozzle with an internal expansion ratio of 22.1 was deemed most suitable. The presence of this nozzle extension slightly increased the model base pressure. Fuselage afterbody flows impinged on the nozzle extension and formed a shock wave at the impingement point. Large longitudinal and circumferential pressure variations existed on the nozzle extension. Deflecting the speed brakes and horizontal tails significantly affected the nozzle pressures; whereas, the addition of the model ramjet did not have an effect. Author

N69-20880*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TUNNEL INSTALLATION EFFECTS ON ISOLATED AFTERBODIES AT MACH NUMBERS FROM 0.56 TO 1.5
Bernard J. Blaha and Donald L. Bresnahan 1969 48 p refs
(NASA-TM-X-52581) Avail: CFSTI CSCL 01A

Pressure distributions and boundary layer data were obtained on three different diameter models used for afterbody studies in the supersonic wind tunnel to determine the quality of the local flow approaching the afterbody region. The support methods for these models included sting mounts and various types of support struts appropriate for jet-exit models. Data were obtained at zero degrees angle-of-attack and Mach numbers from 0.56 to 1.5. Afterbody pressure drag data and the effects of boundary layer momentum thickness on afterbody pressure drag were also obtained on several models for 15-degree conical boattails with jet-boundary simulators. Author

N69-20881*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST AND PUMPING CHARACTERISTICS OF CYLINDRICAL EJECTORS USING AFTERBURNING TURBOJET GAS GENERATOR
Nick E. Samanich and Sidney C. Huntley 1969 34 p refs
(NASA-TM-X-52565) Avail: CFSTI CSCL 01B

Static tests of cylindrical ejectors having ejector to primary diameter ratios from 1.1 to 1.8 and ejector length to primary nozzle diameter ratios from 0.9 to 2.1 are reported. Power setting of the J85-13 turbojet engine was varied from part power to maximum afterburning. Corrected secondary weight flow ratio was varied from 0.02 to 0.06 over a range of exhaust nozzle pressure ratios from 2.0 to 9.0. Secondary flow temperature rise and pressure drop characteristics through the nacelle secondary flow passage were also obtained. Author

N69-20914*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS STUDY OF A BICONE MIXED-COMPRESSION INLET FOR MACH 1.80 TO 2.60
Bernhard H. Anderson Washington Mar. 1969 35 p ref
(NASA-TN-D-5084) Avail: CFSTI CSCL 01A

A theoretical design study was made to evaluate the behavior of a bicone mixed compression inlet over the Mach number range 1.800 to 2.600 and to explore the possibilities in overall performance that may be realized by modifications of the external and internal geometries. For the inlet operating on-design, the results indicate three characteristics are required for favorable surface compression distributions and low flow distortion near the throat

at off-design Mach numbers. These are (1) low-contour curvature of the internal surfaces, (2) nearly equal compression rates on the cowl and centerbody surfaces, and (3) generally low distortion levels in the flow field upstream of the throat. Author

N69-21000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY INVESTIGATION OF FLOW FIELD RESULTING FROM FORWARD-FACING NOZZLES EXHAUSTING NEAR A LARGE CYLINDRICAL BODY AT FREE-STREAM MACH NUMBERS OF 3.0 AND 6.0
Robert J. McGhee and James A. Martin Washington Mar. 1969 40 p refs
(NASA-TN-D-5030) Avail: CFSTI CSCL 01A

The investigation showed that the resulting flow field contained extensive regions of boundary layer separation and mixing adjacent to the cylindrical body. The extent of flow separation on the body depended upon the ratio of jet-exit static pressure to free-stream static pressure, jet-exit Mach number, and free-stream Mach number. An extensive wake region, caused by the limited expansion of the jet exhaust flow at the nozzle lip, was observed around the nozzles and body base at all test conditions. Increasing the angle of attack from 0° to 4° had only a minor effect on the flow field. Large local surface pressures resulted from the initial impingement of the nozzle exhaust on the body. The pressure coefficient on the body just forward of the nozzle exit, when based on jet-exit conditions, was independent of the ratio of jet-exit static pressure to free-stream static pressure and free-stream Mach number. Author

N69-21070# Aeronautical Research Council (Gt. Brit.)
A NUMERICAL METHOD FOR CALCULATING THE PRESSURE DUE TO THICKNESS ON SYMMETRICAL WINGS AT ZERO INCIDENCE IN SUPERSONIC FLOW
R. H. Eldridge and F. Walkden 1968 51 p refs Supersedes ARC-28359, X67-16732
(ARC-R/M-3535; ARC-28359) Avail: CFSTI

The equations of motion for supersonic flow over a symmetrical wing at zero incidence are linearised and the pressure coefficient at a point in the wing mean plane is expressed in terms of the finite part of a singular integral. The equation is modified in such a way that the finite part can be calculated analytically, leaving a regular integral to be evaluated numerically. A method of correcting this value of pressure coefficient, to enable an estimate of the value on the wing surface to be made, is discussed. Numerical results for three wings are given and compared with previous results and with experiment. Author (ESRO)

N69-21090*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BASE PRESSURE DISTRIBUTION OF TWO BLUNTED CONES AT MACH NUMBERS FROM 0.3 TO 0.8 AND 1.81 TO 3.51
Donald W. Kurtz and W. Russell Kerr 15 Oct. 1968 16 p refs
(Contract NAS7-100)
(NASA-CR-100427; JPL-TM-33-403) Avail: CFSTI CSCL 01A

To determine the detailed base pressure distribution on two blunted cones, a wind tunnel test was conducted in the JPL Supersonic Wind Tunnel. The two models, a 60-deg half-angle cone and a 45-deg half-angle cone, were investigated through a Mach number range of 0.3 to 0.8 and 1.81 to 3.51 at angles of attack of 0 to 20 deg. The subsonic wake shape and base pressure were highly insensitive to body shape and angle of attack changes in the range investigated. At supersonic Mach numbers, the base pressure was a distinct function of the wake-neck diameter, which decreased with increasing Mach number. The Reynolds number had a distinct influence on the viscous mixing and wake boundary layer. In the transition region from laminar to turbulent wake, an increase in the Reynolds number resulted in a reduction in the base pressure ratio. Author

N69-21108*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA EFFECTS ON THE AERODYNAMIC CHARACTERISTICS OF A 0.410-SCALE MODEL OF THE CAJUN ROCKET AT MACH NUMBERS FROM 2.30 TO 4.63
Lloyd S. Jernell Washington Mar. 1969 56 p ref
(NASA-TM-X-1771) Avail: CFSTI CSCL 01A

The effects of several proposed antenna configurations on the aerodynamic characteristics of a 0.410-scale model of the Cajun rocket were investigated in a wind tunnel at Mach numbers form 2.30 to 4.63. Data were obtained at angles of attack to approximately 12° for roll angles of 0°, 22.5°, and 45°. The results indicate that the antenna configurations investigated have no significant effects on either the normal force or pitching moment parameters. The turnstile and Dovap antennas contribute appreciably to the axial force coefficient. The greater values of the induced lateral characteristics are generally produced by the quadraloop and Dovap antennas. Author

N69-21133*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.
INTERFEROMETRIC STUDY OF A MACH 5 FLOW AROUND A SPHERE [ETUDE INTERFEROMETRIQUE DE L ECOULEMENTE A MACH 5 AUTOUR D UNE SPHERE]
Jean Louis Solignac Washington NASA Mar. 1969 17 p refs Transl. into ENGLISH from Rech. Aerospatiale (Chatillon-sous-Bagneux), no. 125, Jul.–Aug. 1968 p 31–39
(Contract NASw-1692)
(NASA-TT-F-12121) Avail: CFSTI CSCL 01A

A Mach 5 flow around a sphere was investigated by interferometry. The conditions for use of an interferogram of an axisymmetric flow, in the presence of a shock, are given. A program for calculating the flow downstream of a shock was established on the basis of an experimental determination of specific measurements in the field unstudied. The results of these calculations are in excellent agreement with those corresponding to the second approximation of the Belotserkowsky method. Author

N69-21193*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL INVESTIGATIONS ON WAVE RIDERS (CARET WINGS) IN THE HYPERSONIC RANGE [EXPERIMENTELLE UNTERSUCHUNGEN AN WELLENREITER-FLUEGELN IM HYPERSCHALLBEREICH]
K. Kipke Mar. 1969 204 p refs Transl. into ENGLISH from German Reports DFL-67/39 and DLR-FB-68-41
(NASA-TT-F-12115; DFL-67/39; DLR-FB-68-41) Avail: CFSTI CSCL 01A

A series of wave riders (caret wings) were investigated in the hypersonic gun tunnel in the Mach number range from 7.9 to 15.5. The models investigated had the following parameters: the design Mach number varied between 6 and 10, the aspect ratio between 0.8 and 1.6 and the volume parameter between 0.0675 and 0.1. The tests included three component force measurements, pressure distribution measurements, and determination of the shock wave angle by flow visualization. Three component force data were obtained by use of two strain gauge balances and the pressures were measured by four strain gauge pressure transducers. The aerodynamic coefficients c_L, c_D, c_M and the pressure distributions were compared with simple two dimensional wedge theory. A comparison between an extended Newtonian theory and a pressure distribution measurement shows good agreement. By use of

differential interferometer photographs the shock wave angle was determined and compared with a simplified boundary layer calculation. Author

N69-21251# Boeing Co., Seattle, Wash. Scientific Research Labs.
ON THE NON-LINEAR PROPAGATION OF SHOCK WAVES THROUGH NON-UNIFORM INCOMING FLOWS
Sheldon Weinbaum and Arnold Goldburg Dec. 1968 55 p refs
(D1-82-0799) Avail: Issuing Activity

Propagation of an oblique shock wave through a two-dimensional steady nonuniform oncoming flow is presented. A higher order theory was developed to treat the propagation of an incident oblique shock wave through irrotational or rotational disturbances of arbitrary amplitude. The restrictions of this new theory are: (1) that the flow behind the shock wave locally supersonic as seen by an observer fixed in the reference frame of the shock wave; and (2) that the strength of the incident waves at the rear of the shock front be small compared to (a) the strength of the incoming waves of the opposite family that pass attenuated through the shock front and (b) the emitted waves of the opposite family that are produced by the vorticity or entropy interaction at the shock front. These basic features are employed to derive a new shock refraction relation for steady flows of great generality by combining the oblique shock relations with the characteristic relations at the downstream side of the shock to obtain a single non-linear equation for the turning angle of the flow. Author

N69-21288# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
THEORY OF THE OSCILLATING THIN PROFILE IN A COMPRESSIBLE SUBSONIC FLOW. PART 2: CALCULATION OF KUESSNER'S T-FUNCTION [THEORIE DES SCHWINGENDEN STRECKENPROFILS BEI KOMPRESSIBLER UNTERSCHALLSTROEMUNG. TEIL 2: BERECHNUNG DER KUESSNERSCHEN WIRBELSCHLEPPENFUNKTION (T-FUNKTION)]
F. Wille Oct. 1968 66 p refs In GERMAN; ENGLISH summary
(DLR-FB-68-60) Avail: CFSTI

The T-function depending on Mathieu functions, is calculated for $0 \leq M < 1$, $|\omega^*M| \sim 4,5$. A FORTRAN program for this calculation is included. The convergence of Green's function occuring in the representation of T (M, ω^*) and the possibility of analytic continuation is proven. Author

N69-21289# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
THEORY OF THE OSCILLATING THIN PROFILE IN A COMPRESSIBLE SUBSONIC FLOW. PART 3: CALCULATION OF UNSTEADY AERODYNAMIC DERIVATIVES [THEORIE DES SCHWINGENDEN STRECKENPROFILS BEI KOMPRESSIBLER UNTERSCHALLSTROEMUNG. TEIL 3: DIE BERECHNUNG DER INSTATIONAEREN AERODYNAMISCHEN DERIVATIVA]
F. Wille Oct. 1968 111 p refs In GERMAN; ENGLISH summary
(DLR-FB-68-61) Avail: CFSTI

A method for calculating unsteady aerodynamic derivatives for a thin oscillating profile with control surface and tab is given for the interval of Mach numbers $0 \leq M \leq 1$. The method is based on Kussner's theory of oscillating infinitely thin profiles, where the T function plays an important part. Difficulties of convergence are solved by splitting up the solution into an incompressible and a remaining part. The method is programmed in FORTRAN for the IBM 7040. Some results are represented in figures. Author

N69-21290# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
THEORY OF THE OSCILLATING STRAIGHT LINE PROFILE AT COMPRESSIBLE SUBSONIC FLOW. PART 4: TABLES OF THE AERODYNAMIC DERIVATIVES OF THE OSCILLATING STRAIGHT LINE LINE WITH BEND AND STEP [THEORIE DES SCHWINGENDEN STRECKENPROFILS BEI KOMPRESSIBLER UNTERSCHALLSTROEMUNG. TEIL 4: TABELLEN DER AERODYNAMISCHEN DERIVATIVA DES SCHWINGENDEN STRECKENPROFILS MIT KNICK UND STUFE]
H. G. Kuessner and F. Wille Oct. 1968 241 p refs In GERMAN; ENGLISH summary
(DLR-FB-68-76) Avail: CFSTI

Tables of the aerodynamic derivatives of the oscillating straight line profile with bend and step are calculated, for translation and rotation of the total profile and for the balanced surface. At the control surface translation, the cases of the open and of the closed steps are calculated. The 242 tables contain the derivatives for 11 Mach numbers from 0 to 0.95, for 42 reduced frequencies from 0.001 to 5.0, and for 21 reduced control surface depths from 0.05 to 0.65. Author

N69-21346# Aircraft Research Association, Ltd., Bedford (England).
RECENT RESEARCH INTO SOME AERODYNAMIC DESIGN PROBLEMS OF SUBSONIC TRANSPORT AIRCRAFT
A. P. Haines Jan. 1969 16 p refs Presented at the 6th Congr. of the Intern. Council of the Aeron. Sci. (Icas), Munich, 9–13 Sep. 1968
(ARA-10) Avail: CFSTI

The aims and results of recent research into some design problems of subsonic transports are described. Emphasis is on how to obtain low drag in cruising flight and satisfactory buffet-free performance over the full flight envelope. Discussions are presented on how to design a three-dimensional wing to exploit recent advances in two-dimensional section design and how to devise satisfactory nacelle installations. Continuing research is stressed on the tunnel test techniques required to simulate flight behaviour, and to establish the exchange rates involved in design compromises between aerodynamic and other requirements. Author

N69-21431# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIGITAL DETERMINATION OF SUB-CRITICAL WING PROFILES BY THE HODOGRAPH METHOD [CALCUL NUMERIQUE DE PROFILS D'AILES SUBCRITIQUES PAR LA METHODE DE L'HODOGRAPHIE]
Paul Bevierre 1968 16 p refs In FRENCH; ENGLISH summary
Presented at AGARD Fluid Mech. Group Meeting on Transonic Aerodynamics, Paris, 18–20 Sep. 1968
(ONERA-TP-631) Avail: CFSTI

A hodograph is given for a lifting airfoil with a subsonic velocity at infinity. This hodograph includes a weakly supersonic region without shock. The first step in the computation involves the CHAPLYGIN compressibility law. Such hodograph containing a large number of parameters are obtained analytically. The closure conditions of the corresponding airfoils and the location of I (image of the point at infinity) with respect to the hodograph boundary are obtained with accuracy. Starting from these results, the location of I is changed in order to find some airfoils corresponding to an exact compressibility law. A computational method is then described, involving the determination of a function which exhibits the singular behaviour of the point I. Author

N69-21477*# Lockheed-Georgia Co., Marietta.
MODEL TESTS OF JET INDUCED LIFT EFFECTS ON A VTOL AIRCRAFT IN HOVER
P. K. Shumpert and J. G. Tibbetts Washington NASA Mar. 1969 129 p refs
(Contract NAS1-7891)
(NASA-CR-1297) Avail: CFSTI CSCL 01A

Lift losses and jet decay profiles were measured for 18 nozzle configurations and various airframe configurations at nozzle pressure ratios from 1.4 to 2.3 and at heights from landing gear height to infinity. Outboard-hinged nozzle doors greatly increased the lift losses except near the ground. Increasing nozzle lateral spacing reduced the near-ground losses. Other changes had lesser lift effects. The lift losses out of ground effect correlated well with a jet decay parameter which reflected the amount of jet mixing and the corresponding strength of the induced flow field. After correcting for the effects of differences in the jet decay parameter, the results of the present tests also correlated well with the results of a previous NASA test program which used a similar model. Author

N69-21674# National Aeronautical Establishment, Ottawa (Ontario).
MEASUREMENTS OF FLOW BREAKDOWN IN RECTANGULAR WIND TUNNEL WORKING SECTIONS
P. South Nov. 1968 15 p refs
(NRC-10616; NAE-LR-513) Avail: CFSTI

Details are given on an experimental investigation of the model lift coefficients required to cause flow breakdown in low speed wind tunnels having test section breadth-to-height ratios of 0.5, 1.0, and 2.0. A family of jet flap wing models was used. The model height-to-span, the momentum-area-to-tunnel-area, and the model drag-to-lift ratios were varied. Flow breakdown is shown to be primarily a function of the drag-to-lift ratio and a lift coefficient based upon the measured dynamic pressure, measured lift, and the tunnel cross-sectional area beneath the model span. Author

N69-21724# Office National d'Etudes et des Recherches Aerospatiale, Paris (France).
ON THE MATRIX SOLUTION OF THE UNSTEADY SUBSONIC LIFTING PROBLEM: APPLICATION TO CONTROL SURFACES [CONSIDERATIONS SUR LA SOLUTION MATRICIELLE DU PROBLEME PORTANT INSTATIONNAIRE EN SUBSONIQUE, ET APPLICATION AUX GOUVERNES]
Rolland Dat, Leonide Darovsky, and Bertrand Darras 1968 41 p refs In FRENCH; ENGLISH summary
(ONERA-NT-135) Avail: CFSTI

This paper restates more precisely the considerations developed in a previous article on the optimization of the use of the lifting surface theory in subsonic aeroelasticity. The discussion deals with the practical use of the integral equation which binds the perturbation and the pressure on the wing, and with the matrix formulation obtained by representing the pressure within a function base. The meaning of the approximation presented is shown. The application to limited-span control surfaces is examined. It appears that the logarithmic singularities, that are now known, can be introduced without too much complication. Author

N69-21811*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR CALCULATING VELOCITIES AND STREAMLINES ON A BLADE-TO-BLADE STREAM SURFACE OF A TANDEM BLADE TURBOMACHINE
Theodore Katsanis and William D. McNally Washington Mar. 1969 114 p refs
(NASA-TN-D-5044) Avail: CFSTI CSCL 20D

A Fortran 4 computer program was written that gives the blade-to-blade solution of the two dimensional, subsonic, compressible (or incompressible), nonviscous flow problem for a circular or straight infinite cascade of tandem or slotted turbomachine blades. The blades may be fixed or rotating. The flow may be axial, radial, or mixed. The results include streamline coordinates, velocity magnitude and direction throughout the passage, and the blade surface velocities. This method is based on the stream function using an iterative solution of nonlinear finite difference equations. Author

N69-21894# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
GENERAL PERTURBATION THEORY FOR HYPERSONIC AND SUPERSONIC FLOWS PAST A WEDGE
W. H. Hui Sep. 1967 85 p refs
(AASU-276) Avail: CFSTI

A general perturbation theory for hypersonic and supersonic flows past a wedge is developed, which can be applied to both steady and unsteady flows for which the bow shock is attached to the wedge. It may be used to describe inviscid and viscous (by a modification of the body shape to account for the displace; displacement thickness of the boundary layer) flows over both slender and thick, rigid or flexible wedges performing either periodic or aperiodic motions. Its application to hypersonic and supersonic inviscid flows over a wedge in pitching yields, in the most general cases, aerodynamic derivatives in two forms of power series in the frequency parameter and in the reflection coefficient, and also a general criterion for stability. It is shown that two sets of waves contribute to the pressure distribution at the body surface. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-20784# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
AERODYNAMICS OF A MACH 7 POWERED AIRCRAFT [AERODYNAMIQUE D'UN AVION PROPULSE A MACH 7]
René Ceresuela 1968 25 p refs In FRENCH; ENGLISH summary Presented at the 5th AFITAE Colloq. on Appl. Aerodyn., Poitiers, France, 6–8 Nov. 1968 Submitted for publication
(ONERA-TP-657) Avail: CFSTI

The problems of a Mach 7 aircraft, whether it is a space launcher or a commercial or military aircraft, are outlined: a) low-speed and transonic characteristics, b) problems of stability at all speeds, c) integration of the power plant. This last problem is linked to the extreme dimensions of the intake and exhaust ducts. Wind-tunnel experiments have been performed at ONERA at all speeds on hypersonic shapes; their results are presented. Future research problems are pointed out. Author (ESRO)

N69-20848*# San Diego Aircraft Engineering, Inc., Calif.
POTENTIAL STRUCTURAL MATERIALS AND DESIGN CONCEPTS FOR LIGHT AIRCRAFT

Washington Mar. 1969 142 p refs
(Contract NAS2-4423)
(NASA-CR-1285) Avail: CFSTI CSCL 01C

An investigation of various areas associated with the design of light aircraft and a study of structural materials and concepts is presented. The primary objectives of this two-phase study were: (1) to make a comparative evaluation of a wide variety of materials and structural concepts, presently and potentially available for application to light aircraft, by investigating the effect of design, manufacturing, operational, and material requirements on the cost of this class of aircraft; (2) to apply the more promising materials and structural concepts to the conceptual design of light aircraft; and (3) to identify key problem areas where additional research may increase the potential of promising materials or concepts. This report summarizes the results of the comparative evaluation and shows how these results may be applied to the structural design studies of light aircraft. Author

N69-21020*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE TESTS OF AN AIRPLANE MODEL WITH A DOUBLE-DELTA WING, INCLUDING LONGITUDINAL AND LATERAL CHARACTERISTICS AND GROUND EFFECTS
Victor R. Corsiglia, David G. Koenig, and Joseph P. Morelli Washington Mar. 1969 82 p refs
(NASA-TN-D-5102) Avail: CFSTI CSCL 01C

A wind-tunnel investigation has been undertaken to determine the lateral directional, and longitudinal aerodynamic characteristics of a supersonic transport configuration with a double-delta wing of aspect ratio 1.66. Ground effects were also investigated. There was no large reduction in static longitudinal stability at high angles of attack. The trimmed lift coefficient in ground effect, at gear height, was 1.25 times that out of ground effect at the angle of attack for takeoff or landing. Calculations of takeoff performance showed that the takeoff distance can be reduced by increasing the speed beyond that corresponding to the ground limit value of angle of attack. To improve the lift-drag ratio in the takeoff climb, it is desirable to accelerate after lift-off, because the speed for maximum L/D is about 250 knots relative to a takeoff speed of about 190 knots. The improved L/D results in reduced noise at distances greater than 3 miles from brake release and results in more efficient flight. Author

N69-21134# Federal Aviation Administration, Atlantic City, N. J.
IN-SERVICE IMPROVEMENTS TO USAF TOWER CABS Final Report
J. Roy Bradley, Jr. Apr. 1969 54 p
(NA-69-14; RD-69-13) Avail: Issuing Activity

The work done was to design, fabricate, test, and recommend design criteria for air traffic control tower cab consoles. Considerations were given to human factor aspects to ensure that the console design would provide ease of coordination, economy of motion, and accessibility of controls and displays for the controllers. Supplementary areas of investigation included: tower cab light systems, controller chairs, and a recently developed interphone keying system. Recommendations included specifications for a highly versatile tower console of modular design, tower cab illumination criteria, a scientifically designed work station chair, and details on a compact, modular interphone keying system. Author

N69-21139# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut fuer Fugmechanik.
CALCULATION OF THE FREQUENCY RESPONSE OF THE ELASTIC AIRPLANE'S REACTION TO VERTICAL GUSTS AT INCOMPRESSIBLE FLOW [BERECHNUNG DES FREQUENZGANGES ZWISCHEN VERTIKALER BOE UND REAKTIONEN DES ELASTISCHEN FLUGZEUGS BEI INKOMPRESSIBLER STROEMUNG]
D. Fichtner (Ph.D. Thesis) Jan. 1969 120 p refs In GERMAN; ENGLISH summary
(DVL-821; DLR-FB-69-04) Avail: CFSTI

The analysis of gust loads on airplanes in continuous rough air requires the knowledge of the frequency response of the airplane motions. A procedure of the calculation of the frequency response is developed. The airplane may have the degrees of freedom of vertical motion, pitching, wing bending flexibility, wing torsional flexibility, and fuselage bending flexibility. A method is given for the calculation of the incompressible aerodynamic forces on the finite wing. The unsteady downwash on the tail is taken into account by a correct statement. The important influence of the unsteady downwash on the tail and the elastic modes is demonstrated by a numerical example. Author

N69-21157 Air Registration Board, London (England).
CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME; "SPECIAL EVENTS"--MISSED APPROACHES Technical Report, Feb. 1963-Jul. 1967
Jul. 1968 18 p refs
(ARB-TN-93; CAADRP-TR-8) Avail: CFSTI

Fifty missed approaches, defined as overshoots from an altitude of less than 1000 feet above runway level, are briefly analyzed and summarized in tabular form, as to aircraft type, proportion of total landings, and probable cause. The overshoot mansuver is discussed in terms of mean maximum g increment. Pressure height above runway level, mean rate of descent prior to overshoot, and maximum Δg in overshoot due to pull-up mansuver and turbulence combined are included. P.A.B.

N69-21168# National Transportation Safety Board, Washington, D. C.
ANNUAL REVIEW OF US AIR CARRIER ACCIDENTS OCCURRING IN CALENDAR YEAR 1967
Dec. 1968 65 p
(PB-180919) Avail: CFSTI CSCL 01B

The purpose of this report is to present the record of aircraft accidents, incidents to flight, which occurred in U.S. Air Carrier operations during the calendar year 1967. It includes a statistical recapitulation of all accidents, and a brief of each accident containing the essential items of information which fulfill the requirements of the majority of persons using these reports. Author (USGRDR)

N69-21169# Road Research Lab., Crowthorne (England).
THE SKIDDING RESISTANCE OF WET RUNWAY SURFACES WITH REFERENCE TO SURFACE TEXTURE AND TYRE CONDITIONS
F. T. W. Lander and T. Williams 1968 28 p refs
(RRL-LR-184) Avail: CFSTI CSCL 01C

The report summarises the results of braking tests made with an aircraft tyre to study the effect of surface texture, wheel load, tyre pressure, tread pattern and tyre wear on the skidding resistance of wet surfaces at speeds up to 100 km/h (60 mile/h). Of the various factors studied, surface texture affected braking performance to the greatest extent. It was also found that the skidding resistance of the coarse textured surfaces tested was less affected by changes in tyre conditions, such as load, pressure and wear, than the fine textured surfaces. Author (USGRDR)

N69-21353# Aeronautical Research Labs., Melbourne (Australia).
AERONAUTICAL RESEARCH LABORATORIES Annual Report, 1967-1968

G. A. Hawkes, ed. 1968 53 p refs
Avail: CFSTI

The new test facilities include a low speed wind tunnel, a transonic wind tunnel, air drying and cooling plant, and a supersonic intake test rig. Digital and analogue computers were installed for data acquisition. Tests were performed in the wind tunnel at subsonic, transonic, supersonic, and hypersonic speeds. Aircraft structures were tested on thermal effects, fatigue, atmospheric turbulence, vibration and aeroelasticity, and structural analysis. Metal alloys were tested for their possible use in aerodynamics. Turbomachinery also received testing: high temperature turbine blades, fluid mechanics, and gas turbines. Metallurgical investigations on components and materials from service and civil aircraft were undertaken, including work connected with seven incidents and accidents. The Ikara missile and its control system were tested. J.A.M.

N69-21480# Royal Aircraft Establishment, Farnborough (England).
OPERATIONAL LOADS ON A TRANSPORT AIRCRAFT OF THE NORATLAS TYPE [BETRIEBSBEANSPRUCHUNGEN EINES TRANSPORTFLUGZEUGES VOM TYP NORATLAS]
O. Buxbaum Sep. 1968 117 p refs Transl. into ENGLISH from German Technical Report
(RAE-Lib-Trans-1319) Avail: CFSTI

Loads on a transport aircraft of the German Air Force have been recorded continuously during about 100 flights of normal service operation, on the components listed, and are presented in the form of load frequency distributions: Stresses on lower wing, loads on tail plane and elevator, fin and rudder, bending moments on axle joint and oleo of the main undercarriage, cg vertical acceleration. Author

N69-21523# Naval Aerospace Medical Inst., Pensacola, Fla.
FACTOR ANALYSIS OF AVIATION TRAINING MEASURES AND POST-TRAINING PERFORMANCE EVALUATIONS
Richard F. Booth and James R. Berkshire Oct. 1968 18 p refs
(AD-681794; NAMI-1050) Avail: CFSTI CSCL 5/9

Factor structures of Marine jet and helicopter pilot training measures and post-training performance criteria are compared and discussed. Academic ability, flying ability, and systems comprehension factors were common to both samples. Additional factors unique to each sample were also identified. Significant relationships were found between some performance criteria and some factors, although the criteria factor loadings were low. The results of the investigation are compared with previous factor analytic studies of aviation training measures that did not include post-training criterion data. Author (TAB)

N69-21567# Boeing Co., Renton, Wash. Commercial Airplane Div.
BASELINE ANALOG SIMULATION FOR EVALUATION OF BRAKE ANTI-SKID SYSTEMS
R. L. Amberg Nov. 1968 39 p
(AD-681955; D6-58384-3TN) Avail: CFSTI CSCL 1/3

The note considers a baseline analog computer hardware simulation for the evaluation of anti-skid systems. The dynamic equations of the airplane strut, wheel, tire, and brake are derived and an analog computer simulation developed. The simulation is to serve as a baseline for the comparison of existing anti-skid systems, and, as a base which can be improved to provide a closer representation of the airplane. Author (TAB)

N69-21575# National Physical Lab., Teddington (England). Ship Div.
EXPERIMENTS ON THE SKIRTED HOVERCRAFT RUNNING AT ANGLES OF YAW WITH SPECIAL ATTENTION TO WAVE DRAG
J. T. Everest and R. C. Willis Nov. 1968 27 p refs
(NPL-SHIP-119) Copyright. Avail: CFSTI

Towing tests on a skirted Hovercraft model running at angles of yaw are described in which wave pattern resistance, forces and moments acting on the craft, and craft attitude were measured. The model used for these tests was a third scale model of the HD-2 research Hovercraft. Comparison was made with theoretical wave pattern results. Tests were made at two conditions of model weight and fan speed for yaw angles in the range 0°-80° and for a Froude number of 0.45. Subsequently, tests were made at 0° and 20°, in the Froude number range 0.4-0.8. During earlier experimental work on an unskirted rectangular model, water contact had been experienced and in order to minimise the effects it was found to be necessary to adjust the position of ballast weights throughout the running. In the present study, craft ballast was not moved, and water contact was allowed to develop on the skirts. Author (ESRO)

N69-21581# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.
INTERNATIONAL COMMITTEE ON AERONAUTICAL FATIGUE
J. Y. Mann, ed. Feb. 1968 456 p refs Minutes of the 10th Conf. of the Intern. Comm. on Aeron. Fatigue, Melbourne, May 1967
(ICAF-412) Avail: CFSTI

CONTENTS:

1. REVIEW OF SOME INVESTIGATIONS ON FATIGUE IN THE NETHERLANDS A. Hartman (Nationaal Lucht-en Ruimtevaartlaboratorium) p 21–53 refs (See N69-21582 10-32)

2. A REVIEW OF SWISS INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD JUNE 1965 TO APRIL 1967 J. Branger (Eidgenossisches Flugzeugwerk Emmen) p 55–136 refs (See N69-21583 10-02)

3. A REVIEW OF THE WORK IN THE UNITED KINGDOM ON THE FATIGUE OF AIRCRAFT STRUCTURES DURING THE PERIOD MAY 1965–APRIL 1967 P. D. Adams and E. L. Ripley (Royal Aircraft Estab.) p 137–173 refs (See N69-21584 10-32)

4. REVIEW OF INVESTIGATIONS ON AERONAUTICAL FATIGUE IN THE FEDERAL REPUBLIC OF GERMANY, PERIOD OF REVIEW MAY 1965 TO MARCH 1967 E. Gassner (Laboratorium fur Betriebsfestigkeit) p 175–221 refs (See N69-21585 10-32)

5. REVIEW OF SOME BELGIAN WORKS ON FATIGUE DURING THE PERIOD MAY 1965–APRIL 1967 J. van Laer (Admin. de l'Aeron.) p 223–241 (See N69-21586 10-02)

6. A REVIEW OF RESEARCH ON AERONAUTICAL FATIGUE IN THE UNITED STATES, 1965–1967 H. F. Hardrath (NASA, Langley Res. Center) p 243–293 refs (See N69-21587 10-32)

7. A REVIEW OF RECENT FATIGUE WORK IN ITALY, 1965–1967 V. Villa (Ministero della Difesa Aeron.) p 295–336 ref (See N69-21588 10-32)

8. A REVIEW OF FRENCH WORK ON FATIGUE FOR THE PERIOD 1964–1966 W. Barrois (France. Ser. Tech. de l'Aeron.) p 339–378 refs (See N69-21589 10-32)

9. REVIEW OF SOME SWEDISH INVESTIGATIONS ON FATIGUE DURING THE PERIOD JUNE 1965 TO MARCH 1967 G. Wallgren (Aeron. Res. Inst. of Sweden) p 381–404 ref (See N69-21590 10-32)

10. A REVIEW OF AUSTRALIAN INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD APRIL 1965 TO MARCH 1967 J. Y. Mann p 407–427 refs (See N69-21591 10-32)

N69-21583# Eidenossisches Flugzeugwerk Emmen (Switzerland).
A REVIEW OF SWISS INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD JUNE 1965 TO APRIL 1967

J. Branger, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 55–136 refs (See N69-21581 10-02)
Avail: CFSTI

Gust investigations and fatigue load statistics are reported; test facilities and Venom test programs are described. Methods of damage detection in aircraft inspection are assessed. Fatigue test data are discussed, including a full scale test on DH-112 Venom AC, and tests on oxygen bottles, flexible metallic hoses, compressor blades, canopies, and test rods. Guidelines for service aircraft maintenance are briefly outlined. It is concluded that only fatigue history loading can produce reliable results for aircraft designers, that further research should be devoted to the precrack phase, and that alloys which are less brittle and less sensitive to notches in case of very fast loading rates should be developed. A full complement of tables, graphs, diagrams, and photographs is included. P.A.B.

N69-21586# Administration de l'Aeronautique, Brussels (Belgium).
REVIEW OF SOME BELGIAN WORKS ON FATIGUE DURING THE PERIOD MAY 1965 TO APRIL 1967
J. van Laer, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 223–241 (See N69-21581 10-02)
(MV-67-03) Avail: CFSTI

A description of the test specimen and the loading program for structural testing of the modified (swing tail) Douglas DC-4 fuselage is given. Fatigue pressurization tests, to be also used for DC-6 and DC-7 modifications, tests on the flying controls of the swing tail fuselage, fiber reinforced and unidirectional roving specimens, and residual strength determinations are discussed. Investigations concerning cumulative damage on aluminum alloy S. T. and the effect of low cycle fatigue damage on low alloy heat-treated steel are also reported. P.A.B.

N69-21606# National Center for Atmospheric Research, Boulder, Colo.
DESIGN OF THE STONEHENGE LAUNCH SYSTEM
Jack M. Angevine, John W. Sparkman, and David W. Fulker Feb. 1969 94 p refs Sponsored by NSF
(NCAR-TN-40) Avail: CFSTI

The engineering data required for the construction and use of an improved balloon launch system is presented. The new system is capable of launching heavier payloads of differing sizes and shapes in launch wind conditions up to 15 mph and payload accelerations of less than 1 g; it is also adaptable to the geographic features of various launch sites and relies upon relatively inexpensive equipment. In addition, its design includes allowance for isolation of the payload from the train until just prior to launch and for reorientation of the train in the event of wind shifts prior to launch. Two series of simulated launches were conducted, with a total of 25 releases, as well as a number of realignments for wind conditions. The results of these tests confirmed the performance capability of the system. A.C.R.

N69-21611# Council for Scientific and Industrial Research, Pretoria (South Africa).
A METHOD FOR AIRCRAFT TILT ANGLE DETERMINATION IN THE EVALUATION OF THE PRECISION OF NAVIGATING AND PILOTING INSTRUMENTS [SPOSOB OPREDELENIIA UGLOV NAKLONA SAMOLETA DLIA ISSLEDOVANIIA TOCHNOSTI RABOTY NAVIGATSIONNYKH I PILOTAZHNYKH PRIBOROV]
Iu. N. Kuznetsov 1968 10 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geod. I Aerofotosemka (Moscow), no. 5, 1960 p 119–123
(Ref-695) Avail: CFSTI

A simpler, more economical, and accurate method for determining absolute tilt angles is described, which involves mounting of the aerial camera so that its optical axis is in a fixed position in relation to the axes of coordinates X, Y, and Z. A powerful source of light is mounted under the fuselage, so that during a night flight above a mirror surface of water a virtual image of the light source can be seen below the aircraft at a distance of 2H and on the true vertical line normal to the water surface. An aerial photograph of the virtual image is then taken. Formulas are presented for deriving the absolute tilt angle values based on photographs obtained in this manner, and the accuracy of these values is discussed. Night flight tests using the new method were conducted at 500 m above a muddy river delta which confirmed its suitability in tilt angle determinations for evaluating navigating and piloting equipment precision. It was also found that under certain weather conditions it is possible to obtain a virtual image above water during daytime hours. A.C.R.

N69-21637# Army Aviation Materiel Labs., Fort Eustis, Va.
CH-47A CHINOOK ENGINE LOAD SHARING
L. R. Bartek and R. Hunt Nov. 1968 85 p refs
(AD-682070; USAAVLABS-TR-68-80) Avail: CFSTI CSCL 1/3

The Army is concerned with the problem of unequal load sharing by the engines in its multiengine helicopters. Findings of an engine load-sharing study conducted on the CH-54A Skycrane helicopter in 1965 led to a similar study on the CH-47A Chinook helicopter. Airspeed, altitude, engine gas producer rpm, engine torque, exhaust gas temperature, main rotor rpm, and outside air temperature were recorded during various flight conditions. The gross weight at takeoff and landing and the barometric pressures were also recorded as supplemental data. The data are presented in a series of histograms and tables showing the variations in engine load sharing as a function of the other aircraft parameters. It was found that for the CH-47A Chinook, the relative frequency of occurrence of torque splits greater than 20 percent is less than one-half that for the CH-54A Skycrane. Author (TAB)

N69-21728# Federal Aviation Administration, Washington, D. C. Office of Noise Abatement.
CONFERENCE ON STOL TRANSPORT AIRCRAFT NOISE CERTIFICATION
30 Jan. 1969 148 p refs Meeting held at Washington, 30 Jan. 1969
(FAA-NO-69-1; TR-550-003-03H) Avail: Issuing Activity

CONTENTS:

1. THE FEDERAL AVIATION ADMINISTRATION ROLE IN STOL DEVELOPMENT p 1–2 (See N69-21727 10-02)

2. NOISE STUDY OF TRANSPORT DESIGNS W. H. Deckert (NASA, Ames Res. Center) p 5–24 (See N69-21728 10-02)

3. NOISE SOURCE CHARACTERISTICS OF PROPELLERS AND ENGINES H. H. Hubbard and D. J. Maglieri (NASA, Langley Res. Center) p 25–44 (See N69-21729 10-02)

4. CHARACTERISTICS OF NOISE GENERATED BY DUCTED PROPELLERS AND FANS D. H. Hickey (NASA, Ames Res. Center) p 45–66 (See N69-21730 10-02)

5. STOL NOISE ABATEMENT OPERATIONAL CONSIDERATIONS A. P. Betti and P. D. Wilburn p 67–72 (See N69-21731 10-02)

6. THE STOL PORT AND ITS ENVIRONMENT G. L. Bulsy p 73–81 (See N69-21732 10-02)

7. AIR TRAFFIC CONTROL NOISE ABATEMENT M. H. Reynolds p 83–85 (See N69-21733 10-02)

8. NOISE EVALUATION FOR CERTIFICATION W. C. Sperry p 87–103 refs (See N69-21734 10-02)

9. SOME DEVELOPMENTS IN THE NOISE REDUCTION IN DUCTED PROPELLERS AND FANS D. H. Hickey (NASA, Ames Res. Center) p 104–119 (See N69-21735 10-02)

10. NOISE REDUCTION TECHNIQUES FOR PROPELLERS AND ENGINES D. J. Maglieri, J. L. Crigler, and H. H. Hubbard (NASA, Langley Res. Center) p 120–143 (See N69-21736 10-02)

11. SOME ECONOMIC ASPECTS OF THE AIRCRAFT NOISE PROBLEM G. P. Hunter p 144–155 (See N69-21737 10-02)

12. CONCLUDING REMARKS I. H. Hoover p 156–169 (See N69-21738 10-02)

N69-21727# Federal Aviation Administration, Washington, D. C. Office of Noise Abatement.

THE FEDERAL AVIATION ADMINISTRATION ROLE IN STOL DEVELOPMENT

In its Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 1–2 (See N69-21726 10-02)

Avail: Issuing Activity

A discussion is presented on government interest in STOL transportation, including noise certification, airworthiness, operational requirements, airspace procedures, airport design standards, and navigation equipment. B.P.

N69-21728*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NOISE STUDY OF TRANSPORT DESIGNS

Wallace H. Deckert *In* FAA Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 5–24 (See N69-21726 10-02)

Avail: Issuing Activity CSCL 01A

The study results of the technical and economic feasibility of V/STOL concepts for short haul commercial transport aircraft are reviewed with emphasis on the noise characteristics of STOL aircraft. The attenuation of the perceived noise levels of various illustrated STOL designs is presented. The classical frequency-weighted sound pressure level contours are shown for the STOL aircraft designs on the ground at takeoff power, at takeoff followed by a 20° climbout, and at landing with a 10° approach path. The effect of design propeller tip speed on block speed, gross weight, direct operating cost, and perceived noise level are presented for a turboprop 2000 feet field length STOL craft. The effect of static thrust-to-weight ratio on block speed, gross weight, DOC, and perceived noise level is depicted for pure fan-in-wing and jet flap STOL designs. The results of noise sensitivity analysis are summarized. B.P.

N69-21729*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NOISE SOURCE CHARACTERISTICS OF PROPELLERS AND ENGINES

Harvey H. Hubbard and Domenic J. Maglieri *In* FAA Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 25–44 (See N69-21726 10-02)

Avail: Issuing Activity CSCL 01A

Brief descriptions are presented of the main physical characteristics of the noise generated by propellers, reciprocating engines, and jet engines including both exhaust jet mixing and flow interaction noise components. Illustrations are given of the noise pressure time histories from the above sources. Also included are illustrations of the various types of noise spectra encountered in connection with the above sources and the significance of spectrum shape with regard to annoyance reactions. Low frequency, broad-band, and discrete-tone spectra are discussed and are illustrated along with the shapes of the associated radiation patterns. Brief discussions are also included regarding the current status of theories and methods for predicting noise from the above sources and the atmospheric propagation losses as a function of distance from the sources. Author

N69-21730*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHARACTERISTICS OF NOISE GENERATED BY DUCTED PROPELLERS AND FANS

David H. Hickey *In* FAA Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 45–66 (See N69-21726 10-02)

Avail: Issuing Activity CSCL 01A

How noise is generated is summarized. Some of the characteristics of ducted propeller and fan noise are shown: sound pressure level as a function of frequency for a fan driven by a turbojet engine and the directivity of noise from two ducted propellers, a cruise fan, and lift fans. Rotary wing noise sources (rotational, vortex, and blade) are listed. A typical hovering helicopter noise spectra is analyzed. B.P.

N69-21731# Federal Aviation Administration, Washington, D. C.

STOL NOISE ABATEMENT OPERATIONAL CONSIDERATIONS

Alder P. Betti and Paul D. Wilburn *In its* Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 67–72 (See N69-21726 10-02)

Avail: Issuing Activity

Operational considerations as a means of abating noise are suggested for implementation as an adjunct to the more meaningful ways of suppressing noise; i.e., by better aircraft and/or engine design. The procedures which were established require that aircraft: fly selected approach and departure paths to and from an airport in order to minimize noise complaints; climb and descend to desired altitudes as soon as practical; reduce power before reaching critical noise areas; and execute a turn as soon as practical after departing a runway. An examination of these procedures for STOL operations was done considering the inherent advantages and disadvantages of the STOL aircraft for alleviating the noise problem. B.P.

N69-21732# Federal Aviation Administration, Washington, D. C.

THE STOL PORT AND ITS ENVIRONMENT

George L. Buley *In its* Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 73–81 (See N69-21726 10-02)

Avail: Issuing Activity

Planning, design, and construction criteria are reviewed for STOL ports. The recommendations for a metropolitan STOL port are discussed in relation to noise and effective use of surrounding land. The pros and cons of various hypothetical sites are argued. B.P.

N69-21733# Federal Aviation Administration, Washington, D. C.

AIR TRAFFIC CONTROL NOISE ABATEMENT

Myles H. Reynolds *In its* Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 83–85 (See N69-21726 10-02)

Avail: Issuing Activity

Adjustments in flight traffic patterns are considered relative to the noise abatement problem. The role played by the air traffic controller in STOL landing and takeoff operations is discussed. B.P.

N69-21734# Federal Aviation Administration, Washington, D. C.

NOISE EVALUATION FOR CERTIFICATION

William C. Sperry *In its* Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 87–103 refs (See N69-21726 10-02)

Avail: Issuing Activity

The Federal Aviation Administration, in response to Public Law 90-411, has begun the rulemaking process leading to the

certification of aircraft for noise. The basic element in the regulation criteria is the noise evaluation measure designated as Effective Perceived Noise Level, EPNL, which is a single number evaluator of the subjective effects of aircraft noise on human beings. Simply stated, EPNL consists of instantaneous perceived noise level corrected for tones and duration. EPNL is also the primary element in determining cumulative noise environments in accordance with the methodology called Noise Exposure Forecast, NEF. Author

N69-21735*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME DEVELOPMENTS IN THE NOISE REDUCTION IN DUCTED PROPELLERS AND FANS
David H. Hickey *In* FAA Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 104–119 (See N69-21726 10-02)
Avail: Issuing Activity CSCL 01A

Means of abating noise generated by lift fans are briefly recounted. Recent noise reduction work on rotary wing aircraft included feathering the leading edge and modification of the tip from a rectangle to a trapezoidal planeform; the results are summarized. B.P.

N69-21736*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE REDUCTION TECHNIQUES FOR PROPELLERS AND ENGINES
Domenic J. Maglieri, John L. Crigler, and Harvy H. Hubbard *In* FAA Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 120–143 (See N69-21726 10-02)
Avail: Issuing Activity CSCL 01A

The experience to date is summarized in reducing noise from such propulsion devices as reciprocating engines, propellers, and jet engines including both turbojet and turbofan types. Significant factors in noise generation are indicated for each device. The effects of such factors as tip speed, forward speed, and number of blades for propellers; exhaust velocity of jets; and guide vane spacing and inlet and exhaust duct acoustical treatment for fans and compressors are discussed and are illustrated by means of example data figures. Author

N69-21737# Federal Aviation Administration, Washington, D. C. Office of Noise Abatement.
SOME ECONOMIC ASPECTS OF THE AIRCRAFT NOISE PROBLEM
George P. Hunter *In its* Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 144–155 (See N69-21726 10-02)
Avail: Issuing Activity

A general discussion is presented on the economic nature of the noise problem; the economic objectives of federal intervention; economic criteria for establishing appropriate levels of regulation; and finally, the rationale employed for determining who should pay for the noise alleviation programs. The problem of aircraft noise was considered to be one of conflict between the recipients and producers of noise. Quantitative economic analysis must be used in choosing regulatory goals which are fair and equitable considering the interests of both groups. A suggestion was made that the criteria of economic efficiency and equity require that the net costs of alleviating aircraft noise be imposed on the industry and be borne ultimately by the air traveler and shippers. B.P.

N69-21738# Federal Aviation Administration, Washington, D. C. Office of Noise Abatement.
CONCLUDING REMARKS
I. H. Hoover *In its* Conf. on STOL Transport Aircraft Noise Certification 30 Jan. 1969 p 156–169 (See N69-21726 10-02)
Avail: Issuing Activity

The NPRM on noise certification of transport and turbojet powered aircraft released on January 8, 1969 was reviewed. The environment in which that NPRM was developed and the differences which exist in relation to development of STOL noise control regulations are discussed. After a brief review of two concepts which have been considered within FAA, a recommendation was made for personal assistance and participation in the development of a noise certification rule which will assure that the potential offered by STOL operations can be realized in a socially acceptable manner. Author

N69-21829*# Serendipity Associates, Chatsworth, Calif.
THE LANDING TASK AND PILOT ACCEPTANCE OF DISPLAYS FOR LANDING IN REDUCED WEATHER MINIMUMS
R. A. Behan and F. A. Siciliani Dec. 1964 120 p refs
(Contract NAS2-1346)
(NASA-CR-73301) Avail: CFSTI CSCL 01B

An analytical and empirical study is presented of the information requirements and the nature of a display for landing in reduced weather minima. The VFR landing task is analyzed to determine information requirements and to determine the manner in which information is used. It was found useful to construe the information available to the pilot as analogous to a compensatory display. An acceptance study was made to determine pilot preferences for information display. The results indicate that pilots prefer a windscreen display which presents a pictorial representation of the landing situation and the relationship between the aircraft and the glide slope and localizer. A display concept is presented which conforms to these information requirements and is based on the pilot preferences determined. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-20742# Leesona Corp., Great Neck, N. Y. Moos Labs. Div.
HIGH RATE PRIMARY ZINC/AIR BATTERY Quarterly Report, 16 Nov. 1967–15 Feb. 1968
Emanuel G. Katsoulis and Bernard Randall Nov. 1968 37 p
(Contract DAAB07-67-C-0432)
(AD-681240; ECOM-0432-3; QR-3) Avail: CFSTI CSCL 10/3

The electrode components were finalized. The electro-chemical and economic optimization of the cathode was completed with the selection of a .003-inch electrode backing layer and a .005-inch flexible expanded nickel current collector. The pressed powder anode with a perforated copper current collector was chosen over the paste anode for the final design. Five-cell batteries utilizing the intermediate design were fabricated and discharged at the 0.3 and 2.5 amp rate at 75F; the required 16 amp-hrs was achieved in both cases. Discharging the battery on an 18:2 minute duty cycle at 0.3 amps and 2.5 amps respectively, simulating radio transceiver operation, yielded over 18 amp-hrs. Anode wet storage at 125F was extended to three months without significant capacity loss. Initial bicell activated storage to one month also showed promising

results. The new production cell design was completed and tested as single cells. Intercell separator materials were investigated with plastic foams showing the most promise. Author (TAB)

N69-20780*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC ANALYSIS OF PERMANENT MAGNET STEPPING MOTORS
David J. Robinson Washington Mar. 1969 65 p refs
(NASA-TN-D-5094) Avail: CFSTI CSCL 09C

A dynamic analysis of permanent magnet stepping motors for multistep operation is described. Linearized transfer function for single-step responses are developed. Multistep operation, when the motor is driven by a current source, is analyzed by using phase plane techniques. Failure of the motor to operate for fixed stepping rates and load torques is discussed. Dimensionless curves showing maximum stepping rate as a function of motor parameters and load torque are developed and experimentally verified. The curves allowed the maximum stepping rate of a motor with viscous, inertial, and torque loads to be predicted from simple measurements of the motor parameters. Author

N69-20797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NONCAVITATING AND CAVITATING PERFORMANCE OF SEVERAL LOW AREA RATIO WATER JET PUMPS HAVING THROAT LENGTHS OF 3.54 DIAMETERS
Nelson L. Sanger Washington Mar. 1969 35 p refs
(NASA-TN-D-5095) Avail: CFSTI CSCL 10B

Performance of several jet pumps was determined having diffuser included angles of 2.5° and 6° over a range of spacings of the nozzle exit from the throat entrance of 0 to 3.0 throat diameters. The throat length was found to be too short to permit matching with a conventional diffuser (6° included angle) because significant mixing continued into the diffuser entrance. However, due to the low rate of diffusion the pump having the 2.5° diffuser achieved the relatively high efficiencies of 31.5 percent for a nozzle-to-throat area ratio of 0.066, and 38.7 percent for an area ratio of 0.197. Author

N69-20828*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF THE SNAP-8 LUBRICATION AND COOLANT SUBSYSTEM
H. B. Block, R. Kruchowy, and J. D. Gallagher Washington Mar. 1969 29 p refs
(NASA-TM-X-1731) Avail: CFSTI CSCL 06N

A SNAP-8 system containing all major prototype components except the nuclear reactor and the radiator was assembled and tested for 1445 hours at Lewis Research Center. The overall system consisted of five subsystems. One subsystem lubricated and/or cooled the other four SNAP-8 subsystems. Lubrication and coolant subsystem pump parameters, and component endurance data were examined. Data indicated no degradation in pump performance during the test. Fluid was supplied to the SNAP-8 components at the required flow rate and temperature. None of these components experienced a failure or significant degradation caused by lack of lubrication or cooling. Proper cooling of the mercury pump and the turbine alternator space seals resulted in a very low oil and mercury leakage to the space vacuum simulator. Author

N69-20842# Leesona Corp., Great Neck, N. Y. Moos Labs. Div.
HIGH RATE PRIMARY ZINC/AIR BATTERY Final Report, 15 May 1967–30 Jun. 1968
Emanuel G. Katsoulis and Bernard Randel Ft. Monmouth, N. J. ECOM Dec. 1968 46 p
(Contract DAAB07-67-C-0432)
(AD-681243; ECOM-0432-F) Avail: CFSTI CSCL 10/3

The report describes the work performed during a one-year program to develop a high rate, primary zinc-air battery. The major portion of this report is concerned with the battery testing, and activated storage studies. Five-cell batteries of the final design were fabricated and discharged at the maximum rated current of 2.5 amps at ambient temperatures. At 0F, 70F and 125F the battery delivered 16.7, 16.2 and 11.5 amp-hours respectively. The battery was also evaluated at the low rate (0.3 amp) requirement established for this battery. Anodes activated and stored at 125F for more than six months exhibited an 18% capacity loss upon discharge. Bicells activated and stored for two months at room temperature, and one month at 125F, did not indicate significant capacity loss when discharged. A summary of the component development and battery fabrication completed in the first three quarters is also included. The final optimized battery yielded a materials cost of $0.017 per watt-hour and an energy density of 113 watt-hours per pound. Author (TAB)

N69-20852*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF BRAYTON AND RANKINE CYCLE MAGNETOGASDYNAMIC SPACE-POWER GENERATION SYSTEMS
Lester D. Nichols Washington Mar. 1969 59 p refs
(NASA-TN-D-5085) Avail: CFSTI CSCL 10B

Idealized Brayton- and Rankine-MHD cycles are considered for use in space. The Brayton-MHD cycle uses neon as the working fluid; the Rankine-MHD uses lithium. Both are seeded with cesium. The systems are restricted to a specified generator length and specific radiator area. It is shown that generally an entrance Mach number of 1.0 provides maximum power output; for the same value of Hall parameter the Rankine-MHD system may be used at a lower temperature than the Brayton-MHD; but at the same maximum temperature the Brayton-MHD generates more power than the Rankine-MHD. Subsonic entrance Mach number is recommended for Brayton-MHD, and supersonic for Rankine-MHD. Author

N69-20868*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF AN EXPERIMENTAL SNAP-8 POWER CONVERSION SYSTEM
Robert P. Macosko, William T. Hanna, Sol H. Gorland, and Kent S. Jeffries Washington Mar. 1969 30 p refs
(NASA-TM-X-1732) Avail: CFSTI CSCL 18N

A SNAP-8 experimental power system was operated for 1445 hours over a time span of 1463 hours. Approximately 1100 hours of continuous system operation were achieved. Steady-state system performance did not degrade with time. All SNAP-8 prototype components performed satisfactorily throughout the test with the exception of the parasitic load resistor. Three automatic shutdowns occurred during the course of the test. The automatic protective system employed functioned properly. There was no oil contamination of the mercury loop as a result of the shutdowns. Author

N69-20883*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ROTOR TIP CLEARANCE ON THE PERFORMANCE OF A 5-INCH SINGLE STAGE AXIAL FLOW TURBINE

Donald E. Holeski and Samuel M. Futral, Jr. Washington Mar. 1969 20 p refs
(NASA-TM-X-1757) Avail: CFSTI CSCL 10A

Turbine efficiency decreased linearly with increasing rotor tip clearance. Static efficiency decreased 20 percent (0.79 to 0.63) as rotor tip clearance was increased from 1.2 to 8.0 percent of passage height. Rotor exit flow survey data are presented in addition to performance data. Comparison of data with three reference turbines substantiated the results obtained and indicated that rotor tip clearance effects are larger for a reaction turbine than for an impulse turbine. Author

N69-20913*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF ENDURANCE TESTS OF A SNAP 8 TURBINE-ALTERNATOR
Armen S. Asadourian, Robert J. Frye, Robert P. Macosko, and Richard W. Vernon Washington Mar. 1969 20 p refs
(NASA-TM-X-1741) Avail: CFSTI CSCL 18N

The SNAP-8 turbine-alternator was tested with mercury vapor in a system endurance run. Considerable long term endurance and performance information was obtained. The turbine-alternator accumulated 1445 hours (1110 hr continuous) and was subjected to four starts and stops. During the test period, the electrical power output ranged between 36.8 and 45.6 kW. Prolonged operation of the turbine-alternator did not reveal any degradation in performance or operating characteristics. Author

N69-20937*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD PERFORMANCE EVALUATION OF 4.97-INCH RADIAL-INFLOW TURBINE DESIGN FOR SINGLE-SHAFT BRAYTON CYCLE SPACE-POWER SYSTEM
William J. Nusbaum and Milton G. Kofskey Washington Mar. 1969 24 p refs
(NASA-TN-D-5090) Avail: CFSTI CSCL 10A

Tests were conducted in argon over a range of turbine inlet pressures from 2.95 to 16.40 psia (2.03 to 11.31 N/cm^2 abs) corresponding to a Reynolds number range from 34,950 to 175,800 at equivalent design speed and pressure ratio. Results are presented to show the effect of this change in Reynolds number on turbine performance. Results are also presented in terms of equivalent specific work, mass flow, torque, and efficiency for operation at the design Reynolds number of 76 200 and at speeds ranging from 0 to 110 percent of equivalent design speed with inlet-total- to exit-static-pressure ratios of 1.33 to 2.01. Author

N69-20967 Utah Univ., Salt Lake City.
A CYCLOTRON-WAVE RECTIFIER FOR S BAND AND X BAND
David Colquitt Watson (Ph.D. Thesis) 1968 207 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-11111

A device for converting microwave power into electrical power in either dc or low frequency ac form is investigated both theoretically and experimentally. An electron beam passes through a Cuccia coupler where it receives microwave power in the form of cyclotron rotation, then enters a region of decreasing magnetic field which accelerates the beam along the axis of rotation. The increased longitudinal kinetic energy is recovered as electric energy by a depressed collector. A simple kinematic analysis demonstrates that the Cuccia coupler can convert large amounts of microwave power into electron beam rotation. Limits on the electric field strength and asynchronism between signal frequency and cyclotron frequency are established, for both classical and relativistic coupler operation. Although the inertial mass increase introduces some difficulties in Cuccia coupler operation, these difficulties are surmountable, and satisfactory coupler operation can be achieved for a relatively wide range of operating conditions. Dissert. Abstr.

N69-21016*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF N/P SILICON AND CADMIUM SULFIDE SOLAR CELLS AS AFFECTED BY HYPERVELOCITY PARTICLE IMPACT
Robert L. Bowman, Michael J. Mirtich, and John R. Jack Washington Mar. 1969 16 p refs
(NASA-TN-D-5133) Avail: CFSTI CSCL 10A

A shock tube was used to accelerate particles to hypervelocities for the purpose of simulating micrometeoroid exposure. Various solar cells were then exposed to this simulated environment. The electrical characteristic curves of the cells before and after exposure were measured. The degradation of N/P Si solar cells covered by the thinnest quartz (6 mils or 0.15 mm) was greatly reduced from that suffered by cells without covers. The studies also demonstrated that encapsulated CdS solar cells performed as well as protected silicon for exposure energies less than 0.5 J despite evidence of particle penetration of the encapsulant. Author

N69-21084*# Idaho State Univ., Pocatello. Dept. of Chemistry.
INVESTIGATION OF ELECTRODE MATERIALS FOR ALKALINE BATTERIES Quarterly Report
G. Myron Arcand 25 Feb. 1969 16 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952285)
(NASA-CR-100467; QR-3) Avail: CFSTI CSCL 10C

Chronopotentiometric studies of zinc plate anodes after different preliminary treatments showed significant changes in the value of $i_o\tau^{1/2}$. When electrodes were not permitted to stand quietly in electrolyte solutions saturated with Ag(I) or were allowed to gas vigorously between runs, their behavior suggested that the plates had effective surface areas similar to those found in systems which were never exposed to silver. Values of $i_o\tau^{1/2}$ ranged from 914 mA-$sec^{1/2}/cm^2$ to 1206 mA-$sec^{1/2}/cm^2$. Open circuit potentials for Na(Hg) electrodes were measured for systems with electrolyte concentrations ranging from 5 *VF* to saturated and for various states of charge. While potentials changed in the direction which would be predicted by the Nernst equation for a reversible electrode, the magnitudes differed significantly from Nernst behavior. Maximum open-circuit potentials ranged from −1.91 V vs Hg/HgO at 5 *VF* NaOH to −1.72 V at saturated NaOH. Measurements generally showed poorer precision as the electrolyte concentration increased. Author

N69-21088*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALORIMETRIC EVALUATION OF TWO CONE-COLUMN SOLAR-ENERGY CONCENTRATORS
Marvin D. Rhodes and Conrad M. Willis Washington Mar. 1969 25 p refs
(NASA-TN-D-5109) Avail: CFSTI CSCL 10B

Two cone-column solar-energy concentrators were evaluated in this investigation. Both models had a rim angle of 0.79 radian and an effective radius of 76 cm. The first model was a simplified version of the cone-column with a rigidized cone. This model had a calorimetric efficiency of about 0.55 at an aperture radius of 8.16 solar-image radii. If this efficiency could be attained with a model utilizing a low-mass membrane cone, the cone-column would be competitive with a petalous concentrator designed for use with a Rankine cycle system. The second model was constructed to study some of the problems associated with the fabrication of an

accurate membrane cone. However, the efficiency of this model was only about 0.28 at an aperture radius of 8.16 solar-image radii. The low efficiency of this model is due to markoff and interference of cone gores. The variation in efficiency for misalinement of the concentrator axis with the solar rays indicated that the performance of the cone-column was similar to that of a paraboloid. In addition, it was shown that small variations in misalinement can be compensated for by transverse displacements of the heat receiver. Author

N69-21099*# Texas Instruments, Inc., Dallas.
LITHIUM-DIFFUSED SOLAR CELLS Quarterly Report, 1 Oct.–31 Dec. 1968
Raymond A. Vineyard and Don I. Kendall Jan. 1969 24 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952248)
(NASA-CR-100452; Rept-03-69-15; QR-3) Avail: CFSTI CSCL 10A

A discussion on lithium diffusion from an evaporated source and in a silicon enclosure is presented. The electrical performance and fabrication techniques utilized on shipping lots 5, 6 and 7 are discussed. The spectral response of the cells from lot T-5 were determined to be virtually identical to the response of standard N/P silicon solar cells. Three basic Li concentrations at the junction will be evaluated during the contract. Author

N69-21107*# Mauchly Systems, Inc., Montgomeryville, Pa. Industrial Center.
COMPUTER METHODS FOR THE REDUCTION, CORRELATION AND ANALYSIS OF SPACE BATTERY TEST DATA, PHASE 2, PART 1 Final Report, 1 Nov.–31 Dec. 1967
J. W. Mauchly, J. H. Waite, and S. D. Epstein 31 Dec. 1967 122 p refs
(Contract NAS5-10203)
(NASA-CR-98659) Avail: CFSTI CSCL 10C

The theoretical investigation led to establishing indicators applicable to charge–discharge measurements by which life expectancy could be predicted. The three main computer methods developed for cell life prediction are: first difference voltage histograms that establish the slopes of the charge–discharge curves between individual monitor points on a set of Crane data cycles; superimposed charge–discharge curves; and frequency count/thresholds that establish voltage thresholds and counts the frequency as a given cell passes through it. Combinations of these predictive techniques on a computer with a simple Boolean "and" logic gives the best overall predictive technique. Specific examples are given of each method and various combinations thereof, using 600,000 punched cards of battery testing from the Crane data base. In general, the conclusions are that cell life prediction is feasible with a 1% sample out of 30,000 cycle charge–discharge lifetime history. Recommendations are also made to improve the initial data gathering techniques to facilitate similar future analyses of large volume statistical data on cells. A pseudo-cryptanalytic method of analysis is then performed on the English language postmortem remarks that describe the reasons for each cell failure. Author

N69-21140*# Wilorco, Inc., Long Beach, Calif.
BOOST REGULATOR DESIGN AND DEVELOPMENT
William T. McLyman and K. Willner Feb. 1969 149 p Prepared for JPL
(Contracts NAS7-100; JPL-952293)
(NASA-CR-100448; TR-1001) Avail: CFSTI CSCL 09E

This report covers the theoretical and empirical criteria used in the design of a Pulse and Frequency Modulated Boost Regulator (the so-called Improved Boost Regulator or IBR). All of the operating modes are discussed, and criteria are derived to enable the design of such regulators, given the source and load requirements. Specifically, criteria are developed for sizing the output and input capacitors, the charging inductance, and the starting and drive circuit components. Also included are specific design examples and a comparison of predicted to measured performance. Author

N69-21150*# Radio Corp. of America, Princeton, N. J. Astro Electronics Div.
ACTION OF LITHIUM IN RADIATION-HARDENED SILICON SOLAR CELLS Quarterly Report, 16 Oct. 1968–15 Jan. 1969
G. J. Brucker, T. J. Faith, and A. G. Holmes-Siedle 15 Feb. 1969 35 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952249)
(NASA-CR-100453; AED-R-3426; QR-3) Avail: CFSTI CSCL 10A

The test vehicles being used for this work were (1) small-area solar-cell devices, (2) a group of solar cells, (3) solar cells, and (4) silicon bars, usually in the Hall-bar configuration. The source of particle irradiation used was a 1-MeV electron beam. The physical properties and photovoltaic performance of a large number of cells were measured before irradiation and after recent irradiation to fluences of 1×10^{14}, 5×10^{14}, or 3×10^{15} e/cm^2. A total of thirty-two crucible-grown cells, irradiated to 1×10^{14} e/cm^2, suffered no redegradation in a period extending to 69 days after irradiation. All except five cells showed significant recovery, one group of five having higher power than n/p control cells irradiated to the same level. Float-Zone, Quartz-Crucible, and Lopex cells irradiated showed no redegradation in short-circuit current over a period extending to 11 days after irradiation. Some cells irradiated to 3×10^{15} e/cm^2, however, developed shunt leakages during irradiation or suffered increases in series resistance after irradiation. Measurements on five batches of Float-Zone cells with different lithium diffusion and redistribution schedules indicate a decrease in lithium density and increases in minority-carrier diffusion length and photovoltaic response with increasing redistribution time. Author

N69-21172*# Idaho State Univ., Pocatello. Dept. of Chemistry.
INVESTIGATION OF ELECTRODE MATERIALS FOR ALKALINE BATTERIES Quarterly Report
G. Myron Arcand 25 Nov. 1968 22 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952265)
(NASA-CR-100457; QR-2) Avail: CFSTI CSCL 10C

The results of studies made on deposition of silver on zinc from potassium hydroxide solutions, discharge capacity of amalgam electrodes, and hydrogen overvoltage on zinc are reported and discussed. Tabular and graphical representations of experimental data are included. P.A.B.

N69-21192*# Electro-Optical Systems, Inc., Pasadena, Calif.
PLANETARY SOLAR ARRAY DEVELOPMENT Final Report
A. E. Cariffe 28 Feb. 1969 234 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952035)
(NASA-CR-100459; EOS-7254-Final) Avail: CFSTI CSCL 10B

Work is divided into 3 divisions: environmental analysis and computer program, design of martian hard-lander solar array, and solar panel submodule impact testing. Determination of the ability of a photovoltaic power system to survive a rough landing, and the operating environment on the surface of the planet Mars is presented. A prediction is made of the power output capacity of a somewhat generally specified solar array after landing on the planet. A computer program written for the IBM 1130 is included, along with output for the 30-day period starting 1 February 1974. Author

N69-21330*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REGULATED DC TO DC CONVERTER
Joseph C. Thornwall, inventor (to NASA) Issued 11 Feb. 1969 (Filed 3 Nov. 1966) 7 p Cl. 321-2
(NASA-Case-XGS-03429; US-Patent-3,427,525; US-Patent-Appl-SN-591930) Avail: US Patent Office

A power supply for providing a regulated dc voltage to a fixed or variable load from an unregulated dc voltage source is described. The load voltage regulation is achieved by employing a switching means to alternately clamp and release a transformer-coupled regenerative blocking oscillator. The clamping and releasing rate required to achieve output voltage regulation is determined by the relative magnitude of the input and output voltages and by the power required by the load. As the load increases, the switching means will release the blocking oscillator more often, and the oscillator rate will increase by the correct amount to hold the output voltage content. Energy is transferred directly from the source to the load during the direct or regenerative portion of the blocking oscillator cycle and also during the collapsing flux portion of the cycle.

Official Gazette of the U.S. Patent Office

N69-21337*# McDonnell-Douglas Co., Newport Beach, Calif.
METHOD OF MAKING MEMBRANES
Frank C. Arrance and Daniel G. Soltis (NASA, Lewis Res. Center), inventors (to NASA) Issued 14 Jan. 1969 (Filed 13 Apr. 1965) 6 p Cl. 136–146
(Contract NAS7-150)
(NASA-Case-XGS-03429; US-Patent-3,427,525; US-Patent-Appl-SN-591930) Avail: US Patent Office

This invention teaches an improved method of making an inorganic membrane suited for fuel cell use. Zeolite and a binder, such as zirconium phosphate, are used. Essentially, a mixture of zirconium oxide, phosphoric acid, and zeolite is formed under conditions (such as low temperature and control of the amount of water used) that inhibit bond formation until substantially all physical working of the membrane is complete. Then it is sintered to form the bonds. The resulting membrane is strong, continuous, flexible, can withstand high temperatures, is unaffected by radiation, can be hydrated and dehydrated without ill effect, and has good dimensional stability. Official Gazette of the U.S. Patent Office

N69-21376*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF A MULTISTAGE LIQUID METAL MAGNETOHYDRODYNAMIC POWER CONVERSION CYCLE
L. G. Hays 1 Apr. 1969 12 p refs
(Contract NAS7-100)
(NASA-CR-100500; JPL-TR-32-1371) Copyright. Avail: CFSTI CSCL 10B

A liquid metal magnetohydrodynamic (MHD) power system with power extraction at several stages in the expansion process is discussed and analyzed. Cycle efficiency is shown to improve from the 6% range for a single stage 1800°F system to the 10% range for multistage 1800°F systems. Cycle efficiency at 2000°F is slightly lower but a smaller radiator area is attainable than at 1800°F. The advantages of lower liquid metal velocities and MHD generator redundancy are also possible in a multistage system.

Author

N69-21469*# Beckman Instruments, Inc., South Pasadena, Calif.
PNEUMATIC SYSTEM FOR CONTROLLING AND ACTUATING PNEUMATIC CYCLIC DEVICES
Donald E. Van Arnam and Kyle W. Charlton inventors (to NASA) Issued 14 Jan. 1969 (Filed 20 Apr. 1964) 6 p Cl. 624.14
(NASA-Case-XNP-04264, US Patent-3,421,948; US-Patent-Appl-SN-447933) Avail: US Patent Office CSCL 09E

A fully pneumatic system is described for accurately cyclically controlling a pneumatic device for extended periods. The system includes a supply of pneumatic fluid, pressure reducing means, and first and second conduit means from the pressure reducing means with flow restricting means to regulate the pressure in the first conduit. Both conduits are attached to a pneumatic oscillator which is in the form of a spool valve having adjustable volume chambers. The oscillator has first cooperative passage means for directing fluid from the first conduit to the right hand volume chamber and venting the left volume chamber in one position and directing fluid to the left hand volume chamber and venting the right hand chamber in a second position. There is a second cooperative passage means for directing fluid from the second conduit to the controlled device in the first position and venting the device in the second position. The adjustable chamber allows the relative time fluid as delivered or vented to be regulated. Magnets are provided at each end to provide snap action.

Official Gazette of the U.S. Patent Office

N69-21539*# Radio Corp., of America, Princeton, N. J. Astro-Electronics Div.
CONNECTOR STRIPS: POSITIVE NEGATIVE AND TABS
Charles R. Paek and Lewis E. Boodley, inventors (to NASA) Issued 14 Jan. 1969 (Filed 21 Apr. 1966) 8 p Cl. 174-72
(NASA-Case-xgs-01395; US-Patent-3,422,213; US-Patent-Appl-SN-545535) Avail: US Patent Office

Thien, electrically conductive connector strips for electrically and mechanically coupling a plurality of electrical elements, such as solar cells, are constructed such that the various sections thereof are joined by stress relieved areas. With particular application to the interconnection of solar cells in the formation of an array, the connectors have the ability to accomodate repeated expansion and contraction cycles and, at the same time, still maintain maximum electrical output from the array.

Official Gazette of the U.S. Patent Office

N69-21576# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
CONVERTERS OF CONTINUOUS CURRENT FOR THE GENERATION OF REGULAR HIGH TENSION [CONVERTIDORES DE CORRIENTE CONTINUA PARA LA GENERACION DE ALTA TENSION REGULADA]
Horacio S. A. Picard 1968 63 p refs In SPANISH
(CNEA-211) Avail: CFSTI

The design, construction, and principles of operation of a source of high voltage are considered, for possible application as a power source for radiation detectors. The high voltage unit consists of a transistorized 12/1200 V continuous current to continuous current converter, which is self-oscillating at approximately 20 kc/s. To obtain the ratio of transformer windings compatible with the specified frequency, a four stage multiplier circuit of the Greinacher type is provided. The output is connected to a RC filter, whose function is to reduce the residual voltage to the specified level.

Transl. by F.O.S.

N69-21771*# Pratt and Whitney Aircraft, East Hartford, Conn.
HIGH PERFORMANCE TURBOALTERNATOR AND ASSOCIATED HARDWARE. 1: DESIGN OF TURBOALTERNATOR

R. Cohen, W. K. Gilroy, and W. B. Spencer Washington NASA Mar. 1969 215 p refs
(Contract NAS3-6013)
(NASA-CR-1290; PWA-3070-Vol-1) Avail: CFSTI CSCL 10B

The National Aeronautics and Space Administration is conducting an evaluation of Brayton cycle turbomachinery configurations. As part of this program, a turboalternator has been designed incorporating a two stage axial flow turbine driving an inductor alternator supported on gas bearings. The gas bearing rotor support system was successfully tested in a gas bearing dynamic simulator and in the turboalternator under electrical load and fault conditions to impose magnetic unbalance forces. A total of about 300 hours of operation was accumulated on the gas bearings with about 200 hours under electrical load. A backup gas bearing system was designed and various experimental investigations were conducted to verify certain areas of the turboalternator design in addition to the gas bearing testing. The turboalternator was successfully tested at design conditions in a high temperature loop. Author

N69-21863*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
AN UNSATURATING SATURABLE CORE TRANSFORMER
Francise C. Schwarz, inventor (to NASA) Filed 4 Nov. 1968 19 p
(NASA-Case-ERC-10125; US-Patent-Appl-SN-773029) Avail: CFSTI

An unsaturating magnetic core was developed for use in transformers in electrical power processing equipment. The unsaturating core consists of two separate cores that operate in parallel. The function of the composite core transformer is described as part of a common parallel inverter within a dc to dc conversion system. The composite core is designed so that impending saturation of the core causes a warning signal to be generated which is then used to terminate current conduction in the primary circuit. NASA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-20703# Armed Forces Radiobiology Research Inst., Bethesda, Md.
EFFECT OF MIXED GAMMA-NEUTRON RADIATIONS ON THE SPECTRAL ABSORPTION OF INDOCYANINE GREEN
L. W. Davis, J. A. Brown, and T. A. Strike Sep. 1968 14 p refs
(AD-681372; AFRRI-TN68-7) Avail: CFSTI CSCL 6/18

Blood from beagles and aqueous solutions of indocyanine green were separately irradiated with mixed gamma-neutron radiations at five doses from 0.53 to 48 kilorads. The light absorption of the irradiated dye in combination with irradiated blood was characterized. In addition, unirradiated dye was mixed with irradiated blood and similarly studied. The shape of the absorption spectrum was the same for all samples; the absorptivity of unirradiated dye was unaffected by mixing with irradiated blood; and the absorptivity of irradiated injectable solutions (5 mg/ml) was unchanged. Author (TAB)

N69-20885*# Martin Co., Baltimore, Md. Research Institute for Advanced Studies.
A STUDY OF THE CHEMOSYNTHETIC GAS EXCHANGER Quarterly Progress Report, 24 Sep. 1968–22 Jan. 1969
Leonard Bongers 22 Jan. 1969 41 p refs
(Contract NASw-1596)
(NASA-CR-100417; QPR-7) Avail: CFSTI CSCL 06M

Energy mobilization in autotrophic grown hydrogen bacteria derives ultimately from the oxidation of hydrogen. Oxygen consumption is thus a measure of the amount of energy delivered to the biosynthetic process and the ratio of the rate of oxygen consumption over the rate of CO_2 consumption is a measure of the efficiency of the biosynthetic process. The consumption ratio (O/C) of cell suspensions of *Hydrogenomonas eutropha* was studied with particular reference to the growth rate. The best efficiencies (O/C between 2 and 3) were observed with cultures growing at the maximum growth rate. When the rate of growth was limited by the supply of inorganic nutrients or by CO_2 a less efficient conversion was obtained (O/C values between 3 and 5). An evaluation of gas consumption characteristics suggested that under excellent growth conditions the oxidative and assimilatory activities are well balanced, and that under these conditions about 5 moles of ATP are expended in the conversion of 1 mole of CO_2 to new cell material. Author

N69-20909*# Space/Defense Corp., Birmingham, Mich.
[ON THE DEVELOPMENT OF A POTATO RESPIROMETER FOR BIO-RHYTHM STUDIES] Technical Report, 4 Nov. 1968–4 Feb. 1969
Paul J. Heberlein and Jeffry S. Life 6 Mar. 1969 18 p refs
(Contract NASw-870)
(NASA-CR-100413; TR69-103) Avail: CFSTI CSCL 06B

Biorhythmic studies on teleost fishes under the influence of arginine vasotocin established an inverted swimming pattern in response to a photostimulus from below. The development and evaluation of single and multi-specimen respirometers contained for later use in the Apollo Applications program. Fabrication of respirator bench models has been started. G.G.

N69-20912# Joint Publications Research Service, Washington, D. C.
BIOTELEMETRY GIVES MEDICAL DATA ON SPACE FLIERS
V. Parin 10 Mar. 1969 4 p Transl. into ENGLISH from Nedelya (Moscow), no. 3, 1968 p 5
(JPRS-47807) Avail: CFSTI

The problem of collecting and processing medical information during manned space flights is discussed. A system for recording data during prolonged space flights includes chest bands with mounted electrodes for obtaining electrocardiograms, respiratory pickups, and seidmocardiographic sensors. Telemetric channels from the spaceship transmit successively electroencephalograms, electrooculograms, dynamograms, and written signals. An onboard computer converts oscillograms into quantitative indicators or symptom-signs of medical information for transmission over telemetric channels to earth or to a physician onboard the spaceship. G.G.

N69-20915*# Miami Univ., Coral Gables, Fla. School of Medicine.
REPORT OF TOXIC EFFECTS OF FLUORINE FOLLOWING SHORT-TERM INHALATION
M. L. Keplinger 31 Dec. 1968 273 p
(Grant NGR-10-007-012)
(NASA-CR-100415) Avail: CFSTI CSCL 06T

The toxic effects from short-term (ranging from 5 to 60 minutes) exposures to fluorine were determined in experimental animals and in the human subject. Special equipment, including a chamber for exposures, was designed and built to handle fluorine safely. Analytical methods for the determination of the concentration of fluorine in air were developed. Signs of intoxication from high concentrations of fluorine in air were marked irritation of the mucous membranes of the eyes and respiratory tract, and some

irritation to the skin. The LC50 (concentration calculated to kill 50% of the animals) was determined for 5, 15, 30, or 60 minutes of exposure in rats, mice, guinea pigs, and rabbits. There were no significant differences between the LC50's for the different species of experimental animals. Exposure of volunteer human subjects caused irritation of the eyes and nose. Irritation of the eyes was the most sensitive index of a subjective effect. Concentrations of 25 ppm were slightly irritating after five minutes of exposure; 50 ppm was irritating within one or two minutes, and 75 to 100 ppm were very irritating within a few seconds. Author

N69-20924*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.

MEASUREMENT OF ABSORBED RADIATION DOSES DURING FLIGHTS OF SPACE VEHICLES [OB IZMERENII POGLOSHCHENNYKH DOZ RADIATSII PRI PODETAKH KOSMICHESKIKH KORABLEY]

B. M. Makhmudov Washington NASA Mar. 1969 8 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. III: Fiz.-Astron. (Moscow), v. 23, no. 2, 1968 p 11–16
(Contract NASw-1692)
(NASA-TT-F-12162) Avail: CFSTI CSCL 06R

Radiation doses are given which were received by the astronauts: Gagarin, Titov, Nikolayev, Popovich, Schirra, Cooper, Bykovskiy, Tereshkova, Yegorov, Feoktistov, Komarov, Leonov, and Belyayev during their space flights. The results suggest an absence of radiation hazards for manned space flights at altitudes from 200 to 400 km and an absence of intense chromospheric bursts. Extrapolated daily radiation doses incident in space vehicle cabins are given for flight altitudes up to 2000 km. Author

N69-20987# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

IMPROVED METHODS FOR THE MEASUREMENT OF GAMMA EXPOSURE RATE IN THE NATURAL RADIATION ENVIRONMENT

A. Cardinale and L. Frittelli 12 Nov. 1968 36 p refs
(RT/FI(68)54) Avail: CFSTI

The separate contributions to the exposure rate, due to the natural gamma background radiation can be measured, directly in the field, by means of spectrometric methods. Though these methods are rather crude and unsophisticated, good precision can be obtained by using proper elaboration systems. In this report a calibration method is discussed for measurements of exposure rate, using a NaI(Tl)3" × 3" detector. The system of elaborating field spectra for giving exposure rate, is discussed too. Some results obtained are compared with the data furnished by a very sensitive ionization chamber. Author

N69-21074*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

CONTRIBUTIONS ON THE DEVELOPMENT MECHANICS OF EMBRYOS [BEITRAGE ZUR ENTWICKELLUNGSMECHANIK DES EMBRYO]

Wilhelm Roux Washington NASA Mar. 1969 46 p Transl. into ENGLISH from Arkhiv fuer Mikroskopische Anatomie (USSR), v. 29, 1887 157–212
(Contract NASw-1692)
(NASA-TT-F-12068) Avail: CFSTI CSCL 06C

Experiments and observations conducted on frog ova are reported with the intention of determining the phases and processes which govern embryo development. The following questions are considered: how and in what material shifts occur after the copulation of the two pronuclei, which are definitive in the development of the future embryo; and the black and white poles at each end of the ovem axis correspond, after fertilization, to the ventrocephalic and dorso caudal directions of the embryo. Relevant literature is considered, and a numbered summary is provided, including illustrations. Author

N69-21079# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

USE OF THE CERENKOV EFFECT IN THE DETECTION AND ASSAY OF BETA-EMITTING RADIONUCLIDES IN BIOLOGICAL SPECIMENS [UTILISATION DE L'EFFECT CERENKOV POUR LA RECHERCHE ET LE DOSAGE DE RADIO-NUCLIDES EMETTEURS BETA DANS LES ECHANTILLONS BIOLOGIQUES]

V. Camera and H. Tanguy 1968 8 p refs In FRENCH; ENGLISH summary
(EUR-4084.F) Avail: CFSTI

A rapid and simple method for the measurement of Sr^{90} + Y^{90} and P^{32} in biological materials is described. The determinations are done on aqueous solution using the Cerenkov effect. The time required for urine analysis is about 90 min. and the sensitivity with good precision is in the range of 20 pc of Sr^{90} + Y^{90} per liter and 70 pc of P^{32} per liter. Author

N69-21080*# Techtran Corp., Glen Burnie, Md.

DETERMINATION OF THE NUMBER OF FREE PHOSPHATE GROUPS IN E. COLI RIBOSOMES BY OPTICAL METHODS [OPREDELENIYE KOLICHESTVA SVOBODNYKH FOSFATNYKH GRUPP V RIBOSOMAKH E. COLI OPTICHESKIMI METODAMI]

V. I. Permogorov et al Washington NASA Mar. 1969 Transl. into ENGLISH from Molekul. Biol., Akad. Nauk SSSR, Inst. Radiats. i Fiz.-Khim. Biol. (Moscow), v. 2, no. 2, 1968 p 276–281
(Contract NASw-1695)
(NASA-TT-F-12118) Avail: CFSTI CSCL 06M

The effect of acridine orange on the structure of *E. coli* ribosomes was examined. It was shown that the native structure of ribosomes was destroyed in response to dyeing, when the ratio of the number of dye molecules to the number of binding sites was high. At low ratios such destruction did not take place. The spectrophotometric titration and the induced optical rotatory dispersion measurements at low ratios of dye to binding sites indicated that in the RNA of intact *E. coli* ribosomes approximately 20 per cent of the phosphate groups were able to bind the acridine orange molecules. Author

N69-21109*# Aztec School of Languages, Inc., Acton, Mass.

CONTRIBUTIONS TO THE KNOWLEDGE OF INDIRECT VISION. 1: STUDIES ON THE SPATIAL SENSE OF THE RETINA [BEITREGE ZUR KENNTNISS DES INDIRECTEN SEHENS. 1: UNTERSUCHUNGEN UEBER DEN RAUMSINN DER RETINA]

Aubert and Foerster Washington NASA Mar. 1969 24 p Transl. into ENGLISH from Arch. Ophthalmol. (Berlin), vol. 3, 1857 p 1–37
(Contract NASw-1692)
(NASA-TT-F-12074) Avail: CFSTI CSCL 06E

Using as a point of departure E. H. Weber's studies on the sense of touch, studies were carried out on a series of experiments designed to shed light upon the spatial sense of the retina. The method consisted of recognizing letters and numbers at various distances from the eye through a blackened tube, light being provided by a jumping spark in order to eliminate irrelevant considerations resulting from accomodation to light. Author

N69-21132*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

PHYSIOLOGICAL SYSTEMS ANALYSIS OF TEMPORARY EYE MUSCLE DISTURBANCE DUE TO STRESS IN AIR AND

SPACE TRAVEL [EINE PHYSIOLOGISCHE SYSTEMANALYSE VON STRESSINDUZIERTER VORUBERGEHENDER AUGENMUSKELSTORUNG UND DEREN BEDEUTUNG IN DER LUFT- UND RAUMFAHRT]

Leonard Michael Fenning Washington NASA Mar. 1967 13 p refs Transl. into ENGLISH from German Reprint W 68-30

(Contract NASw-1692)

(NASA-TT-F-12105) Avail: CFSTI CSCL 06S

Attention is directed to the lateral heterophoria as well as the binocular evaluation of landing distances and similar calculations of remoteness. It was determined that in certain flight conditions, esophorias, i.e., latent strabismus towards the inside, or exophorias appear, which could lead to landing mistakes. In the case of exophoria, we have short landings. In the case of exophoria, overflying of the landing field. The changes of the optical perception, which occur in such conditions of stress can be at first roughly divided into two groups of causes: (1) mechanical shifting of the eyeballs during the acceleration phases; and (2) increase of the inner pressure of the skull on the cardiovascular and the cerebro-spinal liquid system caused by physical and emotional stresses. Author

N69-21144*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.

CONGENIAL DOUBLE FORMATIONS IN THE FROG AND THEIR ORIGINS [UEBER DOPPELBILDUNGEN BEIM FROSCH UND DEREN ENTSTEHUNG]

G. Born Washington NASA Feb. 1969 5 p Transl. into ENGLISH from Breslauer Arzliche Z. (West Ger.), no. 14, 22 Jul. 1882 p 162–163

(Contract NASw-1692)

(NASA-TT-F-12049) Avail: CFSTI CSCL 06C

Investigated was the relationship between artificial fertilization and the occurrence of 12 double formations among approximately 2000 developed eggs of a female frog. It was determined that over-maturity of the frog eggs was responsible for the abnormal development; a limited number of overripe eggs were penetrated by two spermatozoa after the normal spawning time. G.G.

N69-21146# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

EXCRETION OF NITROGEN COMPOUNDS FROM RAT LARGE INTESTINE AFTER WHOLE-BODY IRRADIATION IN ABSENCE OF STRESSORS

A. Logar, I. Kregar, and D. Lebez Oct. 1968 7 p refs

(NIJS-R-544) Avail: CFSTI

Increase in nonprotein nitrogen excretion was found 3 hrs after 600 R and 1 hr and 3 hrs after 1200 R. This increase is thought to be ascribed to the effect of ionizing rays. Compared with previous results, it can be assumed that anesthesia and stress, due to the conditions of irradiation, partially protect the organism from the development of gastrointestinal syndrome. Author

N69-21149*# Naval Aerospace Medical Inst., Pensacola, Fla.

THE SOMATIC CHROMOSOMES OF THE MONGOLIAN GERBIL (MERIONES UNGUICULATUS)

Steven P. Pakes 3 Jan. 1969 11 p refs

(NASA Order-W-12766)

(NASA-CR-100458; NAMI-1056; Rept-4) Avail: CFSTI CSCL 06M

From the study of bone marrow cells after intraperitoneal injection of colchicine, it was determined that the diploid number of chromosomes for the Mongolian gerbil is 44. The karyotype was constructed by arranging the chromosomes into four distinct groups and includes 32 meta- or submetacentric and 10 acrocentric autosomal chromosomes. The X element was identified as a large submetacentric chromosome and the Y element as a medium-sized submetacentric chromosome. The study was initiated to characterize the somatic chromosomes of the Mongolian gerbil prior to conducting experiments concerned with the effects of various environmental factors encountered in space flight on mammalian chromosomes. Author

N69-21200*# Naval Aerospace Medical Inst., Pensacola, Fla.

MOTION SICKNESS SUSCEPTIBILITY UNDER WEIGHTLESS AND HYPERGRAVITY CONDITIONS GENERATED BY PARABOLIC FLIGHT

Earl F. Miller, II, Ashton Graybiel, Robert S. Kellogg, and Robert D. O'Donnell 13 Jan. 1969 16 p refs

(NASA Order W12396)

(NASA-CR-100462; NAMI-1057) Avail: CFSTI CSCL 06P

Motion sickness as provoked by parabolic flight maneuvers and induced by active head movements during the hypergravity phases in certain subjects did not occur in any of the five subjects witout functional labyrinths. Among the 25 normal pilot-type subjects, great inter- and intra-individual differences were found in susceptibility to motion sickness under the different force environments used in this study. Acute motion sickness developed in four subjects merely as a result of the oscillations of g-load encountered in the parabolic maneuvers, while the remaining 21 were symptom free. These 21 and the most resistant subject among the other four were tested on other and separate occasions to determine the effect upon their susceptibility of standardized head movements during: (1) the hypergravic phase; (2) the weightless phase of the parabola while they were restrained in an aircraft seat; and (3) the weightless phase while they were rotated in a chair. Four of the six subjects tested under condition 1 were completely unaffected. Head movements during weightlessness under condition 2 provoked severe symptoms in five and moderate symptoms in one of twelve subjects tested. The 15 subjects rotated in weightlessness under condition 3 revealed either a marked positive or negative change in susceptibility relative to that measured by a similar method under terrestrial conditions. Author

N69-21222*# Aztec School of Languages Inc., Acton, Mass. Research Translation Div.

CONTRIBUTION TO KNOWLEDGE OF THE ORIGIN OF NYCTITROPIC MOVEMENTS [BEITRAGE ZUR KENNTNIS DER ENTSTEHUNG DER SCHLAFBEWEGUNGEN]

W. Pfeffer Washington NASA Jan. 1969 129 p refs Transl. into ENGLISH from Abhandl. Saechs. Akad. Wiss. Leipzig, Math. Naturw. Kl. (Berlin), v. 34, 1915 p 3–154

(Contract NASw-1692)

(NASA-TT-F-11940) Avail: CFSTI CSCL 06F

A detailed discussion is presented on the capability for autonomous circadian movement cycling in several nyctitropic plants. The methods of bandaging and automatic recording are described. Experiments were performed on *Tulipa* and *Crocus* blossoms, pinnate leaflets of *Albizzia* lophantha, *Calendula* arvensis and *Bellis* perennis blossoms, *Phaseolus* vulgaris leaves, *Flemingia* (Moghania) congesta leaves, and the joint of the main leaf stem of *Mimosa* speggazzinii. Examples of the presence and absence of circadian autonomous movements are given, and the interaction of these movements with aitionastic reactions is discussed. Influences from the illuminated lamina were found to cause photonastic stimulus of the darkened joint and to deter the onset of darkness rigor. It was determined that autonomous circadian movement capability does not exist in *Tulipa* gesneriana, *Albizzia* lophantha, or *Flemingia* congesta, and does exist in *Phaseolus* vulgaris and *Calandula* arvensis. Since all of these plants do exhibit nyctitropic movements, it is concluded that nyctitropic movements do not require autonomous movement activity. N.E.N.

N69-21223*# Oregon State Univ., Corvallis.
SYSTEMATIC DESCRIPTION AND KEY TO STREPTOMYCES ISOLANTS FROM CHILE, ARIZONA, AND ANTARCTICA DESERT SOILS
W. B. Bollen and Sumie Nishikawa Pasadena, Calif. JPL 18 Feb. 1969 215 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950783)
(NASA-CR-100445) Avail: CFSTI CSCL 06M

Sixty-seven isolants from Chile, Arizona, and Antarctica desert soils have been examined. Of these, thirty-seven have been identified; nine were cultured on the various media but these could not be classified and were designated "indeterminate"; twenty could not be subcultured from the original slants. With the exception of two, non-sporulating cultures, all the streptomycete cultures isolated from Antarctica desert soil were identified as *Streptomyces longisporoflavus*. The non-sporulating cultures may be variants of *S. longisporoflavus* as their colony characteristics are similar to other cultures which have been identified as *S. longisporoflavus*. The materials and methods used to characterize the isolants listed in this report are identical to those described in the first of the reports on the streptomycetes. Author

N69-21255*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.
STUDIES ON THE INDUCTION OF DORSIVENTRALITY IN BROOD BODY SEEDLINGS OF THE MARCHANTIA. 5: THE REVERSIBILITY OF DORSIVENTRALITY INDUCED BY EXTRINSIC FACTORS [UNTERSUCHUNGEN UEBER DIE INDUKTION DER DORSIVENTRALITAET BEI DEN BRUTKOERPERKEIMLINGEN DER MARCHANTIEEN. 5: DIE UMKEHRBARKEIT DER DURCH AUSSENFAKTOREN INDUZIERTEN DORSIVENTRALITAET]
Hans Fitting Washington NASA Mar. 1969 108 p refs Transl. into ENGLISH from Jahr. fuer Wiss. Botan. (West Ger.), v. 86, 1938 p 107–227
(Contract NASw-1692)
(NASA-TT-F-12039) Avail: CFSTI CSCL 6C

Studies on the reversibility of the dorsiventrality (leaves) induced by extrinsic factors are discussed with consideration of relevant literature. Experiments were mainly concerned with the liveworts *Marchantia* polymorpha and *Lunularia*. Gaining insight into the behavior of the *Marchantia* brood body seedlings is reported and especially the question of when and how photoinduction and geoinductions of seedling dorsiventrality are irreversibly stabilized. The author proceeds from the assumption (as opposed to the work of Mirbel, Pfeffer, and Dachnowski) that unilateral dorsiventrality induced in brood bodies by extrinsic factors is completely reversible; that, however, they are entirely independent of the visible germination of the brood bodies and of the morphological development of dorsventrality in the seedlings. It becomes stable under certain physiologically comprehensible conditions. Author

N69-21264# National Physical Lab., Teddington (England). Ship Div.
THE BIOLOGY OF NO. 3 TOWING TANK OF SHIP DIVISION NPL
I. Hartley (Salford Univ.) Nov. 1968 19 p refs
(NPL-SHIP-130) Copyright. Avail: CFSTI

The growth of organisms at 60–65° F in a water tank filled in 1957, and still containing the same water, is analysed and their significance as drag reducing agents is discussed. ESRO

N69-21288# National Defense Research Organization TNO, The Hague (Netherlands). Medical Biological Lab.
INDUCTION AND REJOINING OF BREAKS IN THE DEOXYRIBONUCLEIC ACID OF HUMAN CELLS IRRADIATED AT VARIOUS PHASES OF THE CELL CYCLE
P. H. M. Lohman Aug. 1968 22 p refs
(MBL-1968-15) Avail: CFSTI

The induction and rejoining of single strand breaks in the DNA of asynchronous and synchronized cultures of human kidney cells (T-cells) were investigated. The assessment of breaks was carried out with a modified alkaline sucrose gradient technique. The cells were lysed on top of the gradient in the presence of tri-isopropyl-naphtalene sulphonic acid (TIPNS) and 4-amino salicyclic acid (PAS). The sedimentation pattern of DNA was studied after X-irradiation with doses up to 40 krad. Breaks could be detected by irradiating cells with doses higher than 5 krad. With synchronous cell populations the smallest induction of breaks was found in the DNA of cells progress from late S to early G2. More breaks were induced in early S and G1. The rejoining of breaks in the DNA was studied during incubation of the cells at 37°C after X-ray exposures to 5 and 20 krad. The capacity of rejoining breaks seems to fluctuate slightly in the different phases of the cell cycle being most effective in early S and minimal in G2 phase. Author

N69-21309# National Defense Research Organization TNO, The Hague (Netherlands). Medical Biological Lab.
REPORT OF A VISIT TO THE UNDERWATER MEDICINE SYMPOSIUM, "UEBERLEBEN AUF SEE" [VERSLAG VAN EEN BEZOEK AAN HET DUIKHEDISCH SYMPOSIUM "UEBERLEBEN AUF SEE"]
E. Meeter and O. Brocades Zaalberg Jun. 1968 18 p refs In DUTCH; ENGLISH summary Meeting held at Kiel, 4–5 May 1968
(MBL-1968-10) Avail: CFSTI

The contents of the papers read at the second international diving-medical symposium held at Kell, Germany, are summarized. Diving in shallow waters as well as deep diving operations were discussed. Specifically, the papers covered diving history and qualifications for divers; breathing studies, exercise tolerance, barotrauma, oxygen toxicity, cold exposure, and decompression; U.S. Sealab operations; inert gas mixtures, CO_2 in organisms under high pressure, and behavior of microorganisms under high pressure; and deep-diving mammals as well as various animal experiments under conditions simulating the effects of deep diving. Transl. by K.W.

N69-21310# Aktiebolaget Atomenergi, Stockholm (Sweden).
REPORT ON THE PERSONNEL DOSIMETRY AT AB ATOMENERGI DURING 1967
J. Carlsson and T. Wahlberg Dec. 1968 11 p refs
(AE-342) Avail: CFSTI

This report presents the results of personnel dosimetry at AB Atomenergi during 1967. The external total body gamma dose for all employees (quarterly doses ≤ 100 mrem are not reported) corresponds to 140 manrem. The highest external total body gamma dose during 1967 to one person was 5700 mrem. 24700 gamma films and 3900 neutron films were evaluated. 1988 urine analyses and 989 measurements of body activity were made. Author (ESRO)

N69-21316# Oxford Univ. (England).
DECOMPRESSION SICKNESS AND INERT GAS NARCOSIS Final Scientific Report, 1967–1968
W. D. M. Paton and E. B. Smith Sep. 1968 8 p refs
(Contract F61052-67-C-0077)
(AD-681042) Avail: CFSTI CSCL 6/19

A summary is given of research activities and results in the following areas: Effects of gases in producing decompression sickness; distribution and intensity of bubble formation as a function of time; effects of anesthetic gases on mice; physiological effects

of high pressure on mice; experiments with luminous bacteria; body temperature of mice exposed to raised partial pressures of different gases; oxygen poisoning; properties of gases. TAB

N69-21343# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
APPLICABILITY OF FOURIER TRANSFORMATION UPON CONTRAST SENSITIVITY FUNCTIONS
A. van Meeteren and J. J. Vos [1968] 28 p refs
(IZF-1968-20) Avail: CFSTI

Contrast sensitivity functions of the eye are converted by Fourier transformation into psychophysical line-spread functions. The Fourier transforms were computed with a digital computer (PDP7) for retinal illuminations of .001 to 1000 troland. The linearity of the spatial filtering by the eye and the interpretation of the Fourier transforms as weighting functions of the spatial organization is discussed. Normalized to unity in their centers the weighting functions are stripped of the sensitivity aspect and represent spatial organization only. Simultaneously the normalization factor can be interpreted as an elementary sensitivity. These normalization factors in fact are nothing but the area under the corresponding contrast sensitivity functions. They prove to be proportional to the square root of the retinal illumination below 1 troland, levelling off at 100 troland. This result can be interpreted as a generalization of the De Vries–Rose law, respectively of Weber's law. The weighting functions demonstrate lateral inhibition. Author

N69-21344# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
STRUCTURE OF THE REPLICATIVE FORM OF BACTERIOPHAGE PHI CHI 174. 7: THE RENATURATION OF DENATURED DOUBLE STRANDED PHI CHI DNA
P. H. Pouwels, J. van Rotterdam, and J. A. Cohen [1968] 28 p refs
(TDCK-52607-III; MBL-1968-11) Avail: CFSTI

Denatured double stranded ΦX DNA is formed after exposure of a closed circular duplex to an alkali and renseutralization of the alkali. Under conditions which are optimal for the renaturation of linear phage DNA, denatured double stranded ΦX DNA cannot be renatured. Renaturation will proceed very rapidly, however, in alkaline solution at 50°C. Breakage of a phosphodiester bond in denatured double stranded ΦX DNA will lead to: (a) native double stranded DNA formed in buffers of low ionic strength at 0°–30°C, (b) single stranded DNA formed in buffers of low ionic strength at temperatures exceeding 30°C, (c) a heterogeneous product, presumably consisting of partially renatured DNA, formed in buffers of high ionic strength. These results suggest that the nature of the product of denatured double stranded ΦX DNA, in which a phosphodiester bond is broken, is primarily determined by environmental conditions such as temperature and ionic strength. Author

N69-21349*# IIT Research Inst., Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIROMENTS Quarterly Status Report, 1 Dec. 1968–28 Feb. 1969
28 Feb. 1969 14 p
(Contract NASr-22; Proj. L6023)
(NASA-CR-100503; IITRI-L6023-16) Avail: CFSTI CSCL 06M

Investigations of the effects of daily freeze-thaw cycles and ultraviolet irradiation on the survival of bacteria airborne in dust clouds of soil are presented. Representative types of bacteria present in spacecraft assembly areas or normally indigenous to humans were used: Bacillus cereus, B. subtilis, Escherichia coli, and Staphylococcus aureus. These organisms were inoculated into a limonite coated soil (collected in the Sonoran Desert, Arizona) and were irradiated daily with a Mars daily total equivalent ultraviolet flux over the 2400 to 2800 A region: a value of 298 μWcm^{-2}. Concurrently, the organisms were also exposed to a daily freeze-thaw cycle of 16-hr at −65°C and 8-hr at 30°C. The data indicates that the ultraviolet flux at the surface of Mars may not be as effective a sterilizing agent as previously assumed. Author

N69-21386*# Naval Aerospace Medical Inst., Pensacola, Fla.
MOTION SICKNESS PRECIPITATED IN THE WEIGHTLESS PHASE OF PARABOLIC FLIGHT BY CORIOLIS ACCELERATIONS
Ashton Graybiel, Robert S. Kennedy, and Robert S. Kellogg 18 Feb. 1969 12 p refs
(NASA Order R-93)
(NASA-CR-100502; NAMI-1061) Avail: CFSTI CSCL 06S

Nineteen normal persons and three deaf subjects with bilateral loss of labyrinthine function (L–D subjects) were exposed to Coriolis accelerations during the brief periods of weightlessness in parabolic flight by having them move their heads while rotating in a Bárány chair at 30 rpm. None of the L–D, but all except three of the normal subjects experienced motion sickness. Only one of eight subjects selected on the basis of insusceptibility to symptoms in standard parabolic flights was free of symptoms; the other seven were motion sick and completed on the average only six parabolas. Two of three subjects selected primarily on the basis of low susceptibility to Coriolis acceleration in a slow rotation room were symptom free; one was motion sick but his level of symptoms did not reach the end point of severe malaise during ten parabolas. In addition to demonstrating susceptibility to motion sickness when exposed to Coriolis acceleration in the weightless phase of parabolic flight, the findings are important in emphasizing the difficulty in predicting susceptibility to motion sickness in novel force environments. Author

N69-21390# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
ANOMALOUS PREDICTION OF QUANTUM PROCESSES BY SOME HUMAN SUBJECTS
Helmut Schmidt Feb. 1969 48 p refs
(D1-82-0821) Avail: Issuing Activity

The inherent randomness of quantum processes was used in a device which generates the numbers 1,2,3,4 in random sequence. Preliminary tests suggested that at least one person could, under psychologically favorable conditions, predict the number which the device would generate next, with a probability slightly higher than the expected 1/4. To test this hypothesis, two experiments were conducted in which carefully preselected persons were asked to guess repeatedly the number to be generated next. The results indicate that some subjects have the ability to predict the random numbers better than quantum theory permits. However, less drastic explanations of the high number of hits recorded are considered, such as recording errors, non-randomness of the generated numbers, fraud by the test subject, or the occurrence of the high score as the result of a chance fluctuation. Author

N69-21406# Defence Research Medical Labs., Toronto (Ontario).
THE TRANSIENT RESPONSE OF AN M-LOOP SERIES FILTER SYSTEM WITH SPECIAL APPLICATION TO THE DECOMPRESSION PROBLEM IN MAN: LINEAR MODEL
R. A. Stubbe and R. S. Weaver Sept. 1968 23 p refs
(DRET-620) Avail: Issuing Activity

A theory of body tissue gas saturation and desaturation based on a linear pressure flow law was developed in terms of electrical analogues. The response of an electronic analogue computer based on this linear model was found to be in complete agreement with the theory. Comparisons of the electronic computer predictions of decompression schedules with those obtained from

the experimentally validated pneumatic computer showed good agreement for relatively shallow dives or short exposure times. The electronic computer is not in agreement with the pneumatic computer, however, for deep dives and long exposure times; this was demonstrated to be due to the non-linear behaviour of the pneumatic computer. By inference, the behaviour of the human body is believed to be non-linear with regard to gas transfer in the tissues. Developments based on non-linear theories are presented in another report. Author

N69-21455# Joint Publications Research Service, Washington, D. C.
GRAPH THEORY APPLIED TO AQUATIC ORGANISM COMMUNITIES
V. V. Menshutkin 20 Mar. 1969 10 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (Moscow), no. 1, Jan.-Feb. 1969 p 42-49
(JPRS-47689) Avail: CFSTI

The structure of complexes of heterotrophic animals in a community in terms of the theory of graphs is examined. Concepts of the trophic network and energy balance of the population and community of aquatic organisms underlie the construct. Methods of the theory of graphs are used to calculate the ratio of the biomass and the production of the consortium populations comprising the community under constant conditions. The model of a symbiotic complex consisting of three populations illustrates that at a certain parameter ratio the intermediate trophic link can heighten the efficiency of energy transmission by the community as a whole. A community complex consisting of four populations is also analyzed and the cases are demonstrated in which it is advisable to suppress a predator and in which this is disadvantageous in regard to obtaining maximum catches of individuals in the population undergoing destruction by the predator. The proposed method of theoretical study of communities is visual and uncomplicated, but the area of its application is restricted to stationary conditions and to the region of linear (consortive) relationships in the trophic network. Author

N69-21474# National Defense Research Organization TNO, The Hague (Netherlands).
INTERDEPENDENCY OF SUCCESSIVE RESPONSES IN A PSYCHOPHYSICAL EXPERIMENT
W. A. Wagenaar [1968] 19 p refs
(IZF-1968-21; TDCK15240-III) Avail: CFSTI

Serial non-randomness in a sequence of responses in a psychophysical experiment is measured in such a way that three single factors, causing non-randomness, could be identified. These factors were: sequential response bias, generally favoring repetition of previous responses, constant response bias in favor of one of the two response alternatives, and fluctuations of the threshold, inducing clustering of correct responses. It is argued that the accuracy of a threshold measurement is less than generally assumed, as the mentioned factors increase the variance of experimental results to an unknown extent. The use of parametric methods for testing the significance of differences should be avoided therefore. Author

N69-21525# School of Aerospace Medicine, Brooks AFB, Tex.
EARLY EFFECTS OF 150-MeV PROTON IRRADIATION IN RHESUS MONKEYS
Joseph E. Traynor and Alan M. Siegel Sep. 1968 16 p refs
(AD-681465; SAM-TR-68-87) Avail: CFSTI CSCL 6/18

Rhesus monkeys were exposed to 150-Mev proton irradiation at 11 rads per minute. After exposure, the animals were observed for clinical changes and mortality. Hematologic studies were performed up to 30 days after exposure. On the basis of acute median lethal dose, mean survival time, clinical observations, and blood cell depression, an RBE of unity was assigned when comparing the 150-Mev proton exposure with 2-Mev x-ray exposure. A decrease in median lethal dose was noted with lowered dose rate when proton exposure at 57 rads per minute and 11 rads per minute were compared. Author (TAB)

N69-21533# Army Medical Research Lab., Fort Knox, Ky. Biophysics Lab.
LASER-INDUCED CATARACTOGENESIS. 1: CLINICAL AND ELECTROPHORETIC ALTERATIONS Final Report
Anthony J. Luzzio and Howard M. Leibowitz 8 Oct. 1968 25 p refs
(AD-681899; USAMRL-795) Avail: CFSTI CSCL 6/5

Irradiated animals were followed clinically by examination with the slit-lamp biomicroscope and indirect ophthalmoscope. Laser-induced cataracts were extracted using a cryoprobe and electrophoretic analysis performed on the lens proteins. The clinical course and characteristics of laser-induced lens opacities and of the accompanying ophthalmic sequelae are described. An alteration in the electrophoretic mobility of the lens proteins of laser-induced cataracts is presented. Author (TAB)

N69-21551# School of Aerospace Medicine, Brooks AFB, Tex.
THE EFFECT OF HIGH CONCENTRATIONS OF CARBON DIOXIDE ON BLOOD SEROTONIN LEVELS IN MAN. CHRONIC HYPERCAPNIA
Edward D. Gordon, Jr. Sep. 1968 14 p refs
(AD-681501; SAM-TR-68-107) Avail: CFSTI CSCL 6/18

Whole blood serotonin levels in young men were investigated during exposure to a 4% carbon dioxide environment ($PICO_2$ = 29.9 mm. Hg) for a 10-day period. No significant change in serotonin levels was found in those men sitting as outside controls at ambient (0.03%) carbon dioxide, but there was a 34.0% decrease ($P < .01$) of serotonin levels in men exposed to 4% carbon dioxide. Exposure to 4% carbon dioxide produced throbbing headaches (day 1-2) and nausea (day 4-6). Serotonin levels after an initial depression tended to return to control levels during the 4% carbon dioxide exposure period. Observed correlation between carbon dioxide and serotonin suggests that the role of carbon dioxide in control of cerebral circulation may be mediated through serotonin. Author (TAB)

N69-21606# School of Aerospace Medicine, Brooks AFB, Tex.
DOSE RATE EFFECT OF LD50/30 IN MICE EXPOSED TO COBALT-60 GAMMA IRRADIATION
Joseph E. Traynor and Edwin T. Still Oct. 1968 12 p refs
(AD-682288; SAM-TR-68-97) Avail: CFSTI CSCL 6/18

LD50/30 determinations were made on Swiss Webster female mice exposed to cobalt-60 gamma irradiation at five dose rates between 2.25 and 200 rads per minute. The results are analyzed by the Bateman formula, which makes a very accurate estimation of the LD50/30 in mice in the dose rate range studied. Preliminary data are presented which indicate that this formula will apply to dose rates as low as 100 rads per day. Author (TAB)

N69-21622# School of Aerospace Medicine, Brooks AFB, Tex.
EYE OPACITIES IN FLYING PERSONNEL
Benjamin C. Martin, Thomas J. Tredici, and James R. Culver Sep. 1968 9 p refs Rev. 9-68
(AD-682286; SAM-TR-68-101) Avail: CFSTI CSCL 6/5

An eleven-year summary of eye opacities found at the USAF School of Aerospace Medicine is presented. The type of opacity, its location, and its etiology are stated along with the type of flight rating which the patient held and his disposition as regard flying status. Author (TAB)

N69-21635# School of Aerospace Medicine, Brooks AFB, Tex.
STRESS RESPONSE AS A PREDICTOR OF RADIOSENSITIVITY IN PRIMATES
Horace E. Hamilton and George S. Melville, Jr. Nov. 1968 12 p refs
(AD-682285; SAM-TR-68-122) Avail: CFSTI CSCL 6/18

Macaca mulatta primates were standardized and then subjected to stress in the form of prolonged breathing of an air atmosphere saturated with ethanol vapor. Significant changes ($P < .01$) were noted in their urine volumes and the excretion of electrolytes and 17-hydroxycorticoids. The primates were then irradiated with a lethal dose (1,100 R) of gamma radiation. Their survival times were recorded and tested for correlation with body weights, urine volumes, excretion of electrolytes and corticoids, and post-stress blood alcohol levels. The changes in the Na/K urinary ratio were found to be significantly ($P < .01$) related to the respective postirradiation survival times, but no significant correlation between survival time and the other measurements was detected.
Author (TAB)

N69-21636# City Univ. of New York.
MATHEMATICAL THEORY OF MOLECULAR CONTROL SYSTEMS Final Report
Sumner N. Levine Jan. 1969 9 p refs Prepared in Cooperation with State Univ. of N. Y., Stony Brook
(Grant AF-AFOSR-1396-68)
(AD-681517; AFOSR-69-0140TR) Avail: CFSTI CSCL 6/1

The major emphasis of this report is related to problems associated to theory and mechanism of blood clotting. The first study relates to the thermodynamics of protein adsorption onto surfaces. This study provides a uniform theory of the interaction between proteins and surfaces which takes into account both surface energy and surface charge among other factors. Further studies were undertaken of the mathematical treatment of the cascade theory of blood coagulation, taking into account the regulation provided by negative feedback mechanisms. This work provides an important extension of our earlier studies. Other studies related to bio-electrodes with reference to their applications in energy conversion in physiological environment and as sensing devices.
Author (TAB)

N69-21639# George Washington Univ., Alexandria, Va. Human Resources Research Office.
SOME INTERACTIONS OF SPEECH RATE, SIGNAL DISTORTION, AND CERTAIN LINGUISTIC FACTORS IN LISTENING COMPREHENSION
Thomas G. Sticht Dec. 1968 14 p refs Presented at Psychonomic Soc. Meeting, St. Louis, Nov. 1968 *Its* Profess. Paper 39-68
(Contract DA-44-188-ARO(D)-2)
(AD-681795) Avail: CFSTI CSCL 5/10

The paper reports an experiment designed to determine the effects of speech rate, signal distortion, and certain linguistic factors on listening comprehension. The results indicate that both speech rate and signal distortion may affect listening comprehension, with the latter effects becoming more noticeable with material of low redundancy. Linguistic cues such as inflection and syntax tended to aid listening comprehension.
Author (TAB)

N69-21684# Library of Congress, Washington, D. C.
ELECTROLYTIC THEORY OF PHOTOSYNTHESIS
Boris Nartsissov *In its* Foreign Sci. Bull., Vol. 5, No. 3 Mar. 1969 p 18-24 refs (See N69-21662 10-34)
Avail: CFSTI

Soviet scientists believe that the process of photosynthesis in the live leaf begins with a stage of water electrolysis in the chloroplasts, where electrolytic cells are formed by alternating films of chlorophyll and carotene. The potentials of these two pigments are + 0.15 and − 0.15 *v*, respectively, under laboratory conditions. Experimental studies were conducted for the purpose of modeling the electrolysis of water in cells formed by platinum electrodes coated with the above pigments.
Author

N69-21669*# Aztec School of Languages Inc., Acton, Mass. Research Translation Div.
STUDIES ON THE INDUCTION OF DORSIVENTRALITY IN GERMINATING BROOD BODIES OF MARCHANTIA AND LUNULARIA. 1: INDUCTORS AND THEIR EFFECTS [UNTERSUCHUNGEN UEBER DIE INDUKTION DER DORSIVENTRALITAET BEI DEN KEIMENDEN BRUTKOERPERN VON MARCHANTIA UND LUNULARIA. 1: DIE INDUKTOREN UND IHRE WIRKUNGEN]
Hans Fitting Washington NASA Mar. 1969 48 p refs Transl. into ENGLISH from Jahrb. fuer Wiss. Botan. (West Ger.), v. 82, 1936 p 333-376
(Contract NASw-1692)
Avail: CFSTI CSCL 06F

A method is described which makes it possible to grasp experimentally the question as to which factors of the extrinsic environment bring about dorsiventral structure of the Thalli germinating from morphologically isolateral brood bodies. In addition to unilaterally incident light, which up to now was considered to be the only inductor of dorsiventrality, two other factors must be considered as inductors of dorsiventrality in the germinating brood bodies of Marchantia and Lunularia: the force of gravity and the substratum. It is shown that the morphological outcome of the seedlings depends on the intensities of these three factors: light, gravitational force, and the substratum. It is also shown that if these factors are permitted to act on each other, and/or if they exert a multilateral effect on the brood bodies, then Thalli are obtained which indicate a more or less isolateral formation or even a rare isolateral formation.
Author

N69-21670*# Aztec School of Languages Inc., Acton, Mass. Research Translation Div.
STUDIES ON THE INDUCTION OF DORSIVENTRALITY IN MARCHANTIA BODIES. 2: THE FORCE OF GRAVITY AS AN INDUCTOR OF DORSIVENTRALITY [UNTERSUCHUNGEN UEBER DIE INDUKTION DER DORSIVENTRALITAET BEI DEN MARCHANTIEENBRUTKOERPERN. 2: DIE SCHWERKRAFT ALS INDUKTOR DER DORSIVENTRALITAET]
Hans Fitting Washington NASA Mar. 1969 46 p refs Transl. into ENGLISH from Jahrb. fuer Wiss. Botan. (West Ger.), v. 82, 936 p 696-740
(Contract NASw-1692)
(NASA-TT-F-12037) Avail: CFSTI CSCL 06F

Additional experimental research was carried out to further confirm the influence of gravity on the induction of dorsiventrality in Marchantia and Lunularia brood bodies. Ungerminated brood bodies were exposed unilaterally to the force of gravity for a certain length of time in darkness. They were then subjected to rotation experiments in a clinostat with a horizontal axis. A physiological dorsiventrality was induced which is expressed in a corresponding morphological monosymmetry during germination (in light). The period of presentation for the force of gravity in the ungerminated Marchantia was six hours; in the Lunularia, gebinduction took at least 12 to 16 hours.
B.P.

N69-21689# George Washington Univ., Alexandria, Va. Human Resources Research Office.
DETERMINANTS OF TACTUAL PERCEPTION OF FINGER-DRAWN SYMBOLS: REAPPRAISAL

Douglas S. Holmes, Jon E. Roeckelein, and Joseph A. Olmstead Sep. 1968 19 p refs *Its* Profess. Paper 37–68
(Contract DA-44-188-ARO(D)-2)
(AD-681666) Avail: CFSTI CSCL 6/16

Previous investigators have reported finding individual differences in perception of symbols drawn by finger on the skin. Some have presented alternative formulations of the determinants of tactual perception of symbols. The paper analyzes some of the conceptual and methodological issues involved and presents a third formulation. Author (TAB)

N69-21690# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TWELVE EYE SAFETY NOMOGRAPHS
Paul H. Deitz Dec. 1968 21 p refs
(AD-681906; BRL-TN-1709) Avail: CFSTI CSCL 13/12

A set of nomographs is given to aid in the derivation of probability of retinal damage by a pulsed laser beam, as a function of range for different conditions of atmospheric turbulence and attenuation. Author (TAB)

N69-21711# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF TEACHING MACHINES TO IDENTIFY EXTERNAL SITUATIONS
M. A. Zyzerman, E. M. Braverman, and L. I. Rozonoer Mar. 1968 14 p refs Transl. into ENGLISH from Samoobuchayushchiesya Avtomat. Sistemy (USSR), 1966 p 3–8
(AD-681674; FTD-MT-24-17-68) Avail: CFSTI CSCL 6/4

A method for machine recognition of external stimulae, based on so-called potential functions, is proposed in the paper dealing with artificial intelligence. Individuals can recognize events and patterns, and teach others to do so, frequently without being able to explain how the process of recognition comes about. For instance, an illiterate person can be shown letters a and b and taught to recognize these letters irrespective of their shape. This process of information transfer is therefore based not on explanation, but on demonstration. This technique can be applied to learning, pattern-recognition machines, designed to respond to audio or visual commands. The problem of teaching the automaton to classify correctly a given input can be defined either in the deterministic or in the probabilistic domain. The report describes the application of potential functions to the probabilistic domain, and in conjunction postulates a third theorem. It is concluded that it is in principle possible to apply the demonstration technique to training of automata and that a rigorously scientific, rather than an empirical, approach to the solution of this problem is possible. Author (TAB)

N69-21749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CONTEMPORARY STATE OF THE PATTERN RECOGNITION PROBLEM
V. A. Kovalevskii Mar. 1968 24 p refs Transl. into ENGLISH from Kibern. Dok. Akad. Nauk SSSR (Moscow), no. 5, 1967 p 78–86
(AD-681809; FTD-HT-23-155-68) Avail: CFSTI CSCL 6/4

This article surveys 32 citations (23 Soviet) covering the period up to 1967. Despite the fact that works devoted to the pattern recognition problem have been published for at least 12 years, and in increasing number, as a scientific discipline this problem still can not be considered clearly outlined. Different authors examine different statements of recognition problems; the overwhelming majority generally proceed without a statement and, thus, work on the solution of a problem that can not be formulated. The absence of a sufficiently general statement of the pattern recognition problem impedes the comparison of patterns because of the difficulty of systematizing numerous and very diverse works. Therefore, a statement of the problem that is proposed, evidently, embraces the majority of individual problems of recognition and allows us to examine them from a certain single point of view. TAB

N69-21796# Speech Communications Research Lab., Inc., Santa Barbara, Calif.
SOME PHYSIOLOGICAL PARAMETERS FOR PROSODIC DESCRIPTION
David J. Broad Oct. 1968 221 p refs
(Contract N00014-67-C-0118)
(AD-682242; SCRL-Monograph-3) Avail: CFSTI CSCL 6/18

The objective of the study is to investigate the physiological parameters of voice production in regard to the problem of the description of the prosodic aspect of spoken language. The parameters considered include the length, thickness, and medial compression of the true vocal folds, the tension of the vocalis muscle, the resistance of the glottis to the flow of air, the subglottic pressure, the volume velocity of glottal airflow, and the motions of the laryngeal cartilages. In a study of the mechanics of the laryngeal cartilage system, the degrees of freedom of the cartilage motions are isolated and employed to describe the motions mathematically. It is shown how four quantities which are measurable in a laryngoscopic view depend on the degrees of freedom. The resulting equations are solved to show that it should be possible to evaluate the degrees of freedom from the laryngoscopically measurable dimensions. The relations between the degrees of freedom and changes in the lengths of the intrinsic laryngeal muscles are outlined. An experimental study was conducted to investigate the behavior of some of the physiological parameters of voice production during prosodic variations in the voice. Author (TAB)

N69-21819# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SPECIFIC IMPEDANCE OF THE CEREBRAL CORTEX AT VARIOUS DEPTHS DURING SPREADING DEPRESSION
C. U. Hoffman and F. J. Clark Dec. 1968 166 p refs
(Contract N00014-67-A-0226)
(AD-682239; TR-EE68-38) Avail: CFSTI CSCL 6/16

Specific impedance at various depths in the cerebral cortex was measured at 1.6 kHz using a novel thin film coaxial microelectrode technique which permitted measurement of the impedance of very small volumes of tissue (0.01 cubic mm.). Experiments using rats indicated that spreading depression produces increases in specific impedance 3 - 4 times the resting level, increases which are more than 10 times greater than changes previously reported. The impedance locus in the complex plane was loop shaped, very similar to the cross-section of an airfoil. Significant changes in specific impedance were also produced by asphyxia and by releasing cerebospinal fluid pressure. Author (TAB)

N69-21836# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME QUESTIONS OF THE STATISTICAL THEORY OF SHAPE IDENTIFICATION
A. G. Frantsuz Feb. 1968 18 p refs Transl. into ENGLISH from the book "Nauchnyi Sovet Po Kompleksnoi Probleme Kibernetika. Bionika" Moscow, Nauka, 1965 p 23–32
(AD-682066; FTD-HT-23-1619-67) Avail: CFSTI CSCL 6/4

An analysis of the statement of certain problems in mathematical statistics arising in connection with the problem of form recognition is given. The problem in particular is concerned with the theory of estimates with respect to small

samples in the case of multi-variate distributions; synthesis of secondary characteristics describing an object from primary characteristics; reduction of the number of characteristics to a given number with minimal loss of information. Author (TAB)

N69-21860# Goteborg Univ. (Sweden). Dept. of Otolaryngology.
EFFECT OF NOISE AND TOXIC AGENTS ON THE INNER EAR Final Scientific Report, 1 Aug. 1967–31 Jul. 1968
Hans Engstrom Dec. 1968 7 p
(Contract F61052-67-C-0090)
(AD-681834) Avail: CFSTI CSCL 6/16

Under the contract there has been made an extensive study on the normal and pathologically altered inner ear of animals and man. The normal inner ear has been studied by light, electron and scanning electron microscopy and new techniques have been developed for these studies. The same techniques have also been used for the pathological ears. Damage to the inner ear has been produced by noise and ototoxic agents. In man autopsy material has been used but a special technique has been developed to get optimal fixation. Author (TAB)

N69-21901# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF PROLONGED REDUCED PRESSURE ON THE GROWTH AND NITROGEN CONTENT OF TURNIPS (BRASSICA RAPA)
R. L. Mansell, G. W. Rose, B. Richardson, and R. L. Miller Sep. 1968 20 p refs
(AD-681499; SAM-TR-68-100) Avail: CFSTI CSCL 6/3

Photosynthetic plants are being considered for possible use in atmosphere regeneration and for food supply in extended manned space missions. The effects of potential spacecraft atmospheres on the growth of such plants is important in planning their use. This study investigates the effects of reduced total pressure on one plant, the turnip (Brassica rapa L.). During 21-day exposures to total pressures of 380 and 700 mm. Hg, seedlings and mature turnip plants were periodically harvested and analyzed. The rate of seedling growth, as measured by dry weight increase, was found to be slightly but significantly greater at 380 than at 700 mm. Pressure had no effect on either growth rate or top/root ratio of the older plants. The fact that percent dry weight (ratio of dry weight to fresh weight) was significantly less at 380 mm. suggested an effect of pressure on transpiration pattern. Percent total and protein nitrogen decreased with age at both pressures. In roots, the rate of decrease was unaffected by pressure, but in plant tops, the rate of decrease was significantly greater at 380 mm. This variance indicates a moderate but fundamental effect of pressure on plant metabolism and composition. It was concluded that the effects of reduced pressure were not sufficient to limit the future potential of plants in aerospace applications. Author (TAB)

N69-21904# School of Aerospace Medicine, Brooks AFB, Tex.
SIMULTANEOUS MEASUREMENT OF BLOOD PARAMETERS USING RADIOCHROMIUM-LABELED RED CELLS AND RADIOIRON LABELED PLASMA
Donald F. Logsdon, Jr., James F. Green, Guy M. Strong, and John W. Harper Oct. 1968 12 p refs
(AD-682287; SAM-TR-68-113) Avail: CFSTI CSCL 6/1

Separate procedures for the measurement of erythrokinetics, ferrokinetics, and blood volume have previously been reported. The technic described in this paper measures these parameters simultaneously, thereby reducing the volume of blood and number of samples needed to be drawn, and decreasing the possibility of artifactual variations in parameters. Values obtained by this technic are in good agreement with those resulting from the separate studies. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-20828 Michigan State Univ., East Lansing.
VOWEL RECOGNITION THRESHOLD AS A FUNCTION OF TEMPORAL SEGMENTATION
Richard LaVern Powell (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-11089

The purpose of this study was to determine the vowel recognition threshold as a function of temporal segmentation for certain vowels. Previous studies had suggested three milliseconds as the vowel recognition threshold as a function of temporal segmentation. Each of the vowels was recorded when phonated by a speaker sitting in a sound treated room. A Lissajous figure produced on an oscilloscope as well as a 125 Hz tone presented through earphones aided the speaker in attaining vowels with 125 Hz fundamentals. These vowels were each presented ten times to eight doctoral students with normal hearing for validation. A modified psychophysical method of minimal change was selected as the means for attaining the vowel recognition threshold as a function of temporal segmentation. Dissert. Abstr.

N69-21031# Entelek, Inc., Newburyport, Mass.
COMPUTER-ASSISTED INSTRUCTION: A SURVEY OF THE LITERATURE Annual Technical Report, Oct. 1966–Jul. 1968
Albert E. Hickey, ed. 1 Oct. 1968 161 p refs
(Contract N00014-68-C-0236)
(AD-681079; TR-8) Avail: CFSTI CSCL 5/9

A survey and synthesis of literature pertaining to computer-assisted instruction and published prior to July 1968 are given. Principal headings include An Overview of CAI, Applications of CAI, Major CAI Centers, Systems, Programming Languages, Theory of Instruction, Stimulus and Performance Factors, Program Generation and Evaluation, and Administration of CAI. Author (TAB)

N69-21164# Federal Aviation Administration, Oklahoma City, Okla.
PILOT RESPONSE TO PERIPHERAL VISION CUES DURING INSTRUMENT FLYING TASKS
A. Howard Hasbrook and Paul E. Young Feb. 1968 22 p refs
(FAA-AM-68-11) Avail: CFSTI

To more closely associate the visual aspects of instrument flying with that of contact flight, a study was made of human response to peripheral vision cues relating to aircraft roll attitude. Pilots, ranging from 52 to 12,000 flying hours experience, were tested in a multi-engine aircraft simulator. Data on aircraft bank angle, heading, altitude, peripheral vision cue signals, pilot eye movement, and additional workload accomplishment were obtained during simulated flights involving a typical instrument flying maneuver. Results suggest that substantial gains can be achieved in instrument flying capability by use of peripheral vision cues as they relate to provision of continuous roll attitude (bank angle) information. The data also indicate such cues may be useful in preventing inadvertent entry into steep banks and subsequent loss of control when turbulence prevents visual interpretation of the conventional attitude indicator. Author

N69-21174# California Univ., Los Angeles. Biotechnology Lab.
SOME DESIGN ASPECTS OF AN EXPERIMENTAL FLUIDIC CONTROL SYSTEM
Horst Arp Aug. 1968 27 p refs
(Contract V1005P-9779)
(PB-180954; TR-44; Rept-68-44) Avail: CFSTI CSCL 06B

To provide an idea about typical design procedures the development of a fluidic control system is described. The system is intended to sequence and coordinate the movements of upper extremity prostheses or servo-manipulators. The general method of approach is outlined by a block diagram. Important portions of the circuitry are given in detail: The design of a simple pneumatic force to pressure transducer is discussed, a movement control subsystem suitable for fluidic implementation is shown to be derived from a basic servomechanism concept, and the logic circuitry for a movement coordination system is developed. Finally, some suggestions are made as to the utilization of a pneumatic stepping motor device to improve the positioning accuracy and to provide for a reliable hold function of pneumatic actuators.
Author (USGRDR)

N69-21232# Joint Publications Research Service, Washington, D. C.
CYBERNETICS AND REGULATION THEORY
11 Mar. 1969 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 184, no. 1, 1969 p 28–29, 51–54
(JPRS-47617) Avail: CFSTI

CONTENTS:

1. THE UPPER ESTIMATES OF LENGTHS OF SHORTEST HOMOGENEOUS EXPERIMENTS WITH RESPECT TO RECOGNITION OF THE TERMINAL STATE FOR ALMOST ALL AUTOMATA A. D. Korshunov p 1–4 refs (See N69-21233 10-05)

2. OPTIMAL QUESTIONNAIRES WITH UNEQUAL VALUE OF THE QUESTIONS P. P. Parkhomenko p 5–11 refs (See N69-21234 10-19)

N69-21233# Joint Publications Research Service, Washington, D. C.
THE UPPER ESTIMATES OF LENGTHS OF SHORTEST HOMOGENEOUS EXPERIMENTS WITH RESPECT TO RECOGNITION OF THE TERMINAL STATE FOR ALMOST ALL AUTOMATA
A. D. Korshunov *In its* Cybernetics and Regulation Theory 11 Mar. 1969 p 1–4 refs (See N69-21232 10-05)
Avail: CFSTI

The problem of recognition of the terminal state of an automaton is investigated in this article. Let us assume that a completely defined noninitial automaton which is a sealed "black box" is given and that the experimenter can obtain information about the state of this automaton only by supplying input letters and observing the ouptut letters. On the basis of these observations, the experimenter must determine the state in which the investigated automaton is found, that is, the state of the automaton after the effect of the last input letter on it. The procedure for determining the terminal state of an automaton after introducing the appropriate finite series of input letters and observing the results at the output of the automaton is called an experiment in recognition of the terminal state or simply an experiment. The experiment is said to be homogeneous if the experimenter selects the input series before beginning the experiment and does not change it during the course of the experiment. Author

N69-21266# National Physical Lab., Teddington (England). Div. of Computer Science.
FRAGMENTATION OF PATTERNS OCCURRING WITH TACHISTOSCOPIC PRESENTATION
C. R. Evans Nov. 1968 19 p refs
(NPL-COM-SCI-40) Copyright. Avail: CFSTI

An experiment in which a total of 200 subjects were shown four different patterns with tachistoscopic presentation is described. Statistical results are given and a theory of the fragmentation of patterns is presented in which the human perceptual process can be likened to a working classificatory hierarchy. ESRO

N69-21345# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
THE MICROTHREAD TECHNIQUE. A SIMPLE SYSTEM FOR STUDYING THE AEROSOL-STABILITY OF MICROBES [DE MICROTHREAD TECHNIQUE. EENEENVOUDIG SYSTEEM VOOR ONDERZOEK VAN DE AEROSOL STABILITEIT VAN MICRO-ORGANISMEN]
R. Boerings and H. C. Bartlema Dec. 1968 24 p refs In DUTCH; ENGLISH summary
(TDCK-52606-III; MBL-1968-12) Avail: CFSTI

An apparatus for the microthread technique was constructed for studying the survival of aerosolized micro-organisms during their exposure to air. Aerosol particles of the test organisms were captured on spider threads and exposed to the environmental air simulating a pure airborne state of the adherent particles. The loss of viability was studied and the numbers of test and tracer organisms were determined. Author

N69-21371# Joint Publications Research Service, Washington, D. C.
BRIGHT FUTURE OF CYBERNETICS PREDICTED
V. Glushkov 11 Mar. 1969 7 p Transl. into ENGLISH from Znannya Ta Pratsya (Kiev), no. 1, 1969 p 4–6
(JPRS-47612) Avail: CFSTI

Thoughts on predicting the widespread use of computers in the near future are presented. Areas mentioned in which cybernetics, will in the next twenty years, have an important role are economics, the State Planning Commission, other ministries, banks, all large enterprises, design engineering, and the national economy. Since it is difficult for specialists with fixed scientific orientation to retrain, it is concluded that cybernetics is a young science for the youth. F.O.S.

N69-21380*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JET SHOES
John D. Bird, Howell D. Garner, Ernest D. Lounsberry, and David F. Thomas, Jr. inventors (to NASA) Issued 7 Jan. 1969 (filed 24 Feb. 1967) 7 p Cl. 244-4
(NASA-Case-XLA-08491; US-Patent-3,420,471; US-Patent-Appl-SN-619520) Avail: US Patent Office

An apparatus is described for attachment to the feet of a person desiring extravehicular space locomotion having a fluid thruster controlled by the toes of the person. Toe and heel attachment elements are utilized for securing a base that supports the thruster and a control circuit therefore to each foot. The control circuit is either electric, having a switch for energizing a solenoid valve permitting fluid to flow through a nozzle, or fluidic, having a syringe connected to a relay that operates a valve permitting fluid to flow through the nozzle.
Official Gazette of the U.S. Patent Office

N69-21473*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BALANCED BELLOWS SPIROMETER

George R. Holden and Joseph R. Smith, Jr. inventors (to NASA) Issued 7 Jan. 1969 (filed 21 Aug. 1964) 6 p Cl. 128-2.08 (NASA-Case-XAR-01547; US-Patent-3,420,225; US-Patent-Appl-SN-39343) Avail: US Patent Office

A bellows type spirometer is described which can operate properly under the influence of acceleration forces in any direction. A balanced bellows spirometer comprises a center wall with a bellows mounted on each side of the wall. The bellows are pivotally connected to opposite edges of the center wall and a passage through the center wall interconnects the two bellows chambers into one composite chamber. An inlet is provided into one bellows and an outlet is provided from the other bellows. The two bellows are mechanically interconnected so that the tendency of either bellows to move toward or away from the center wall under the influence of acceleration is resisted by an equal and opposite tendency of the other bellows to move under the influence of the same acceleration. As a result, the bellows are not moved by acceleration forces and yet are free to expand and contract under the forces of air pressure. Official Gazette of the U.S. Patent Office

N69-21478*# National Aeronautics and Space Administration, Washington, D. C.

TELEOPERATOR CONTROL An AEC-NASA Technology Survey

William R. Corliss and Edwin G. Johnsen Dec. 1968 169 p refs (NASA-SP-5070) Avail: CFSTI CSCL 06B

A comprehensive survey on engineering problems in teleoperator control and man machine integration is given. The various technical chapters are divided into: (1) control theory; (2) man-machine interface; (3) control hardware; and (4) displays. Design principles and configurations cover the wide range between hot-cell master slaves to walking machines and their varying electronic subsystems. G.G.

N69-21501*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SIMULATION OF PACKAGE TRANSFER CONCEPTS FOR SATURN 1 ORBITAL WORKSHOP

Charles B. Nelson Washington Mar. 1969 15 p (NASA-TN-D-5111) Avail: CFSTI CSCL 06B

Investigated was the problem of manual transferring massive packages in a zero-g environment from the Saturn docking adapter into the crew quarter areas of the Saturn stage. Only a single handrail was to be used to assist the astronaut during package manipulation. Preliminary transfer simulation studies with a six degree of freedom simulator established the efficiency of the pole and the basic man/package transfer technique. Analysis and correlation of data from the simulations indicated that a combination of package parameter size and mass (moment of inertia) effected package maneuverability; a package with a moment of inertia 3.4 to 4.0 $N\text{-}m\text{-}sec^2$ (300 to 350 $in.\text{-}lbf\text{-}sec^2$) appeared to be the upper limit for one man to transfer within a reasonable time frame. G.G.

N69-21663# Library of Congress, Washington, D. C. Aerospace Technology Div.

THE BIOLOGICAL ROLE OF NITROGEN AND SPACECRAFT CABIN ATMOSPHERES

Boris Mandrovsky *In its* Foreign Sci. Bull., Vol. 5, No. 3 Mar. 1969 p 1–17 refs (See N69-21661 10-34) Avail: CFSTI

The recent announcement that a Soviet scientist "discovered" that animals and higher plants assimilate nitrogen from the air has been acclaimed by the Soviet press as a major scientific breakthrough, but the backdating of this "discovery" to 1951, and certain recent articles, suggest that it may be a move in a power struggle between two schools of thought on the design of spacecraft cabin atmospheres. Author

N69-21682*# Midwest Research Inst., Kansas City, Mo.

BIOMEDICAL APPLICATIONS OF AEROSPACE-GENERATED TECHNOLOGY Quarterly Report, 1 Dec. 1968–28 Feb. 1969

David Bendersky, Wilbur E. Goll, and Donald Roberson 28 Feb. 1969 27 p refs (Contract NSR-26-002-083; MRI Proj. 3217-E(A)) (NASA-CR-100499; QR-3) Avail: CFSTI CSCL 06B

Transfer of aerospace-generated technology to the nonaerospace biomedical field is accomplished by a biomedical applications team, along with five participating institutions and their staffs. The team and the research staffs identify potential solutions to the problems, modify the original technology to adapt it to the biomedical problem, and document and disseminate the successfully transferred problems. Research material considered for transfer included computerized X-ray photograph enhancement; apparatus for learning research and training of mentally retarded children; temperature telemetry system for internal organs; an electrical sensor for bacteria detection; and bloodless perfusion in limb implantation. B.G.D.

N69-21685# Federal Aviation Administration, Oklahoma City, Okla. Dept. of Transportation.

THE MAN IN THE MAINTENANCE RELIABILITY SYSTEM, FOURTH ANNUAL MAINTENANCE SYMPOSIUM

Harry A. Turnpaugh 5 Dec. 1968 282 p refs Symp. held at Oklahoma City, 3–5 Dec. 1968 Avail: Issuing Activity

A series of 20 oral presentations, some including visual aids, are covered. Topics, drawn from industrial, military, and international aeronautical reliability program experience, include: the training and certification of aircraft mechanics, development of managerial competance for reliability programs, the role of the design engineer in reliability programs, the development of new effectiveness criteria, and reviews of various implemented programs. K.R.G.

N69-21707# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

ON THERMAL COMFORT WEARING AVIATION HELMETS, ESPECIALLY IN HELICOPTERS [OVER THERMISCH COMFORT BU HET DRAGEN VAN VLIEGHELMEN, IN HET BIJZONDER IN HELICOPTERS]

N. J. L. v. d. Valk, J. J. Vos, and J. Varkevisser 1968 9 p In DUTCH; ENGLISH summary (TDCK-5219BIII; IZF-1968-19) Avail: CFSTI

After the introduction of green aircraft helmets instead of white ones for crew members of military helicopters, complaints have been heard about headache when flying in the sun for long periods. This report gives the results of a comparison of heat development within white and green helmets, measured during normal flights. These results lead to the advice to re-introduce the white helmet. Author

N69-21773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE AND CAVITATION DAMAGE OF AN AXIAL-FLOW PUMP IN 1500° F (1089 K) LIQUID SODIUM

Dean C. Reemsnyder, Walter S. Cunnan, and Carl Weigel Washington Apr. 1969 25 p refs (NASA-TN-D-5138) Avail: CFSTI CSCL 13L

A low headrise axial flow pump was operated in liquid sodium at temperatures to 1500° F for 558 hr to investigate pump performance and blade cavitation damage in alkali metals. The research rotor had nine insertable blades of three different materials, a blade tip diffusion factor of 0.40, and a hub tip radius ratio of 0.77. Overall performance was obtained, and a 200 hr cavitation endurance test was conducted in 1500° F sodium at 3450 rpm. Post-test blade inspection indicated that there was slight cavitation damage and that the Ni–Cr-base superalloy (René 41) was more cavitation damage resistant to high temperature sodium than either 316 or 318 stainless steel. Author

N69-21843# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
CLEARANCE AND PERFORMANCE VALUES FOR THE BARE-HANDED AND THE PRESSURE-GLOVED OPERATOR
John W. Garrett Aug. 1968 153 p refs
(AD-681457; AMRL-TR-68-24) Avail: CFSTI CSCL 5/5

The report summarizes hand and arm dimensional, clearance, and strength data of 27 adult males wearing the A/P22S-2 full-pressure suit. Thirty-six measures were obtained under each of three conditions: bare-handed; gloved and unpressurized; and gloved and pressurized. The data are both summarized for all subjects and reported independently by glove size worn. Uses of the data are suggested and specific design values recommended. Author (TAB)

N69-21896# Danish Academy of Technical Sciences, Copenhagen.
HORIZONTAL JET DILUTION STUDIES BY USE OF RADIOACTIVE ISOTOPES
Jens Hansen and Hans Schroeder 1968 27 p refs *Its* Acta Polytech. Scand., Civil Eng. and Bldg. Construct. Ser. No. 49
(PB-180787; APS-Ci-49) Avail: CFSTI

Sewage discharge into receiving water often involves use of hydraulic jets in order to obtain an effective mixture of effluent and ambient water. The background for the present study is that existing theories on jet dilution processes have only poor experimental support, and that already presented experimental results are not in satisfactory agreement. The radioisotope tracer technique is found convenient for laboratory purposes since dilution measurements are easily and accurately carried out by use of either sampling technique or in-situ measurements. Improvements in initial jet dilution may be obtained by using special disturbance arrangements placed in front of the jet orifice. Author (USGRDR)

N69-21925*# National Aeronautics and Space Administration. Manned Spacecraft Center, Cape Canaveral, Fla.
ELECTRODE FOR BIOLOGICAL RECORDING
Joe L. Day and Maxwell W. Lippitt, Jr., inventors (to NASA) Issued 7 Jan. 1969 (Filed 31 Dec. 1964) 6 p Cl. 128-2.06
(NASA-Case-XMS-02872; US-Patent-3,420,223; US-Patent-Appl-SN-422864) Avail: US Patent Office

An electrode is described for detecting potential differences generated by parts of the human body. It consists of an electrochemically reversible silver chloride anodized silver disk which contacts the skin through an electrode paste on one face of the disk. A lead wire is soldered to the opposite face, and this connection is then coated with an epoxy resin to preclude contact of it with the paste. This prevents spurious electrical activity which would spoil the quality of the signal.
Official Gazette of the U.S. Patent Office

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-20708 Case Western Reserve Univ., Cleveland, Ohio.
ULTRASONICALLY INDUCED ENHANCEMENTS IN THE RAMAN SPECTRUM OF QUARTZ
Robert Richard Sharp (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-10204

The effect of large amplitude ultrasonic resonance on the Raman spectrum of quartz was observed. Band broadening and intensity enhancements which could be caused by electro-optical anharmonicity were searched for but were not identified. The spectrum was examined for appearance of symmetry disallowed fundamentals, but none of these modes were found. Intensity enhancements with magnitudes up to fifteen percent were seen in Raman active fundamentals and were interpreted as being due to concentrations of silver ions introduced into the lattice during the course of experiments. A strong, highly localized enhancement peak was observed which was thought to be caused by dislocation unpinning from the silver impurities. An analysis based on the theory of ultrasonic loss due to dislocations was found to give good quantitative agreement with experimental results. Dissert. Abstr.

N69-20717# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
SOME MAGNETIC RESONANCE PROPERTIES OF SOLUTION OF SODIUM IN LIQUID AMMONIA [CONTRIBUTION A L'ETUDE DES SOLUTIONS DE SODIUM DANS L'AMMONIAC LIQUIDE PAR RESONANCE MAGNETIQUE]
Claude Lambert (Ph.D. Thesis—Paris Univ., 1 Feb. 1968) Dec. 1968 196 p refs In FRENCH; ENGLISH summary
(CEA-R-3673) Avail: CFSTI

Dilute solutions of sodium in liquid ammonia are studied by means of dynamic polarization techniques, and with the aid of the Becker, Lindquist and Alder model. Paramagnetic shifts are computed, as a function of the "average spin density", for each of the nuclear spin systems. The nuclear contributions to the Overhauser shift are computed in the same way. A theoretical study of the main relaxation processes is carried out for each of the nuclear spin systems and for the electronic spin systems. The dynamic polarization experiments consist of the classical measurement of the Overhauser enhancement and direct measurement of the Knight shift for nitrogen and nuclear contributions to the Overhauser shift by means of double irradiation techniques. The results show that, in dilute solutions, the relaxation of nitrogen arises from quadrupole interaction and from hyperfine interaction with unpaired electrons. Both interactions are of the same order of magnitude. Overhauser shift measurements show that the spin density is negative at the proton site, in agreement with Hughes's results. Author (ESRO)

N69-20731 Louisville Univ., Ky.
THERMAL STUDIES OF HYDROGEN ELECTRODE PROCESSES: A PRELIMINARY INVESTIGATION
Bruce Bannister Graves (Ph.D. Thesis) 1967 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-8005

A new method of combined electrochemical and thermal analysis has been developed as an initial attempt to measure thermodynamic changes associated with electrode processes, especially of transient nature. Equations relating the area under the temperature/time curves to the charge associated with electrode specific electrode processes are derived from theoretical considerations. The general features of differential thermal analysis and differential scanning calorimetry are discussed as they apply to this problem and it is indicated that the latter can provide more quantitative and absolute calorimetric data than can the former, although the former provides a good starting point for investigation through its simpler instrumental requirements. A description is given of the separate lock-in amplifier/dual thermistor temperature bridge system and the conventional triangular sweep voltammetric system. Dissert. Abstr.

N69-20732 Illinois Univ., Urbana.
COMPOSITE MEMBRANES: THE PERMEATION OF GASES THROUGH DEPOSITED MONOLAYERS
Gene Douglas Rose (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-12188

A technique has been developed to determine the mass transfer coefficients of various multimolecular films deposited onto permeable support films. The multimolecular films were deposited using the techniques developed by Langmuir and Blodgett. The change in the concentration of the monolayer during the deposition and the distribution of the deposited monolayer on the support film were checked using radioactive tracer techniques. Three gases were used in these experiments: carbon dioxide, nitrogen, and helium. For every type of deposited layer used, the mass transfer coefficient for each gas was distinct, and it was shown from their relative magnitudes that the process had to depend both on the gas solubility and diffusivity in the deposited monolayers. Dissert. Abstr.

N69-20736 Washington Univ., Seattle.
IONIC MIGRATION EFFECTS ON LIQUID-RESISTANCE-CONTROLLED ION EXCHANGE
Lester Paul Van Brocklin (Ph.D. Thesis) 1968 269 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order No. 68-12720

The effects of ionic migration on the liquid-phase mass-transfer step in packed bed ion exchange and self exchange of the same ionic species showed large differences in rates attributable to ionic migration effects. Based upon three mass transfer models, the film, boundary layer, and penetration models, and two constitutive equations, the Nerst–Planck equation and Fick's Law, calculational techniques were developed and used to predict the effects of ionic migration. Appropriate differential equations corresponding to the three mass-transfer models were integrated on a TR-48 analog computer. Dissert. Abstr.

N69-20737 Michigan Univ., Ann Arbor.
THE SEPARATION OF NITROGEN AND METHANE BY PULSATING FLOW THROUGH A FIXED, MOLECULAR SIEVE BED
Philip Hain Turnock (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-13420

The intent of this investigation was to attain a better understanding of the mechanism and behavior of a periodic, gas separation process. The periodic process utilizes a rapid pressure-swing cycle in an adsorbent bed to effectuate the separation of gas mixtures. During the first portion of a cycle the compressed gas mixture flows into the adsorbent-filled column. Next, while the feed gas is restrained, an exhaust orifice is opened at the feed end of the column providing depressurization. These feed and exhaust periods of a cycle are of such brief duration that a product stream may be withdrawn continuously from the opposite end of the column. A mathematical model based upon the assumption of instantaneous equilibrium between the gas phase and the adsorbed gas was formulated and solved to simulate the periodic, adsorption process. Dissert. Abstr.

N69-20743# Systems Research Labs., Inc., Dayton, Ohio.
RELATIONS BETWEEN POINT DEFECTS IN THE COMPOUND MX2 Interim Technical Report
N. M. Tallan, H. C. Graham, R. W. Vest, and W. C. Tripp
Wright-Patterson AFB, Ohio ARL Oct. 1968 259 p refs
(Contract AF 33(657)-10815)
(AD-681162; SRL-TR-580-D; ARL-68-0188) Avail: CFSTI CSCL 20/2

The results of a computer study of the mass action equations as used for the formation of point defects in binary compounds are presented. The results are in easily read tabular form from which a neutrality condition can be deduced for a particular predominant defect. The pressure dependence and the equilibrium constants involved in the formation of each defect are listed. Author (TAB)

N69-20752 Illinois Univ., Urbana.
ELECTROPHORETIC BEHAVIOR OF ALUMINA SUSPENSIONS
Lawrence Lee Martin (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-12161

The electrophoretic mobility of alumina particles has been studied with respect to electrolyte concentration and pH. A microelectrophoresis cell of the Briggs type was employed for the mobility determinations. The mobility and, therefore, the zeta potential varied as the electrolyte concentration was changed; a maximum zeta potential of −96 millivolts was obtained at a pH of 8.0 and at an electrolyte concentration of 8×10^{-3}N sodium metaphosphate. Electrolyte concentrations greater and smaller than 8×10^{-3}N produced lower zeta potentials. Sodium nitrite, when used as an electrolyte, yielded particle mobilities lower than that when sodium metaphosphate was used. After the pH and electrolyte concentration favorable to maximum mobility were established, alumina deposits were electrophoretically formed using zinc and brass electrodes. The deposits were examined with respect to porosity, density, percent moisture, and the possibility of forming free-standing alumina bodies. Dissert. Abstr.

N69-20770 Wisconsin Univ., Madison.
STUDIES IN ELECTROGENERATIVE HYDROGENATION
Iraj Feiz (Ph.D. Thesis) 1968 409 p
Avail: Univ. Microfilms: HC $18.45/Microfilm $3.00 Order No. 68-9074

Isotope tracer techniques have been extended to electrochemical kinetic studies in order to characterize and evaluate the reactions occurring at the cathode of an electrogenerative hydrogenation system. Deuterium was reacted with unsaturated hydrocarbon gases on a platinum black electrocatalyst using a deuteroperchloric acid electrolyte. A technique was developed for sampling, separation and analysis of the products by a combination of gas chromatography and mass spectrometry. Thus, product distributions could be examined at various stages in the reaction. Dissert. Abstr.

N69-20773 New York Univ., N. Y.
MONTE CARLO CALCULATIONS FOR OFF-LATTICE POLYMERS WITH AND WITHOUT SIDE GROUPS
Elizabeth Joan Loftus (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-13131

The effects of rotations about tetrahedral lattice points and of side groups upon the non-self-intersecting random walk polymer modes were investigated using Monte Carlo techniques to obtain the configurational properties. The forms of the basic equations were unchanged, but values of λ, b, and b' were found to be dependent on rotation angle, and to change dramatically with the addition of side groups, casting doubts upon the chemical validity of results found for the tetrahedral lattice. Dissert. Abstr.

N69-20775*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
EFFECTS OF LITHIUM AND OXYGEN LOSSES ON THE MAGNETIC AND CRYSTALLOGRAPHIC PROPERTIES OF SPINEL LITHIUM FERRITE

D. H. Ridgley, H. Lessoff, and J. D. Childress Washington Mar. 1969 31 p refs
(NASA-TR-R-305) Avail: CFSTI CSCL 07B

A study of the effects of sintering temperatures and cooling rates on the magnetic and crystallographic properties of spinel lithium ferrite shows that both the magnetic moment and lattice parameter increase with sintering temperature. Either annealing at lower temperatures or slow cooling under oxygen causes reoxidation of the Fe^{+2} formed at higher temperatures with attendent decreases in moment and lattice parameter and gradual precipitation of α–Fe_2O_3 as a second phase. The various products formed were shown to be equivalent to solid solutions of spinel lithium ferrite with Fe_3O_4 on rapid cooling and to solid solution of lithium ferrite and γ–Fe_2O_3 with precipitation of α–Fe_2O_3 on slow cooling. Lithium losses and α–Fe_2O_3 precipitate amounts are calculated. The magnetic moment and lattice parameter of stoichiometric lithium ferrite were determined: magnetic moment at 25°C = 3736±20G; lattice parameter at 28°C = 8.3293±0.0005Å. Author

N69-20791 Yale Univ., New Haven, Conn.
CONDENSATION OF ICE CLUSTERS BY HOMOGENEOUS NUCLEATION FROM THE VAPOR PHASE
Gilbert Douglas Stein (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-13206

An experiment providing a direct determination of the homogeneous nucleation rate process for a phase change from the vapor state. A direct measurement of final particle size and concentration after the phase change using the method of light scattering, is carried out. The experimental results are then compared to the various existing theories. The phase change studied is that of water vapor to ice using a supersonic nozzle which is part of a new wind tunnel designed and built especially for this experiment. Condensation of the water vapor in moist air takes place in the nozzle. The mean particle size obtained directly from the scattering measurements agree in general with the classical theory of homogeneous nucleation. The agreement with theory is within the bounds of reasonable assumption for the fundamentally unknown surface free energy of the small ice clusters observed. Dissert. Abstr.

N69-20801*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON OF TWO SPECTROPHOTOMETRIC METHODS FOR THE DETERMINATION OF PALLADIUM IN TITANIUM-BASE ALLOYS
Warren F. Davis Washington Mar. 1969 28 p refs
(NASA-TM-X-1767) Avail: CFSTI CSCL 07D

This report compares extraction procedures using 1–nitroso 2–naphthol and dimethylglyoxime for the spectrophotometric determination of palladium in titanium-base alloys. Dimethylglyoxime has greater selectivity but lower sensitivity, similar precision (about 25 ppm at the 0.2 percent level), is faster, and covers a wider range of palladium contents than does 1–nitroso 2–naphthol. The dimethylglyoxime procedure has no interferences by any of the common or potential alloying elements, for example, cobalt, niobium, and tantalum; thus it is well suited to the determination of 0.1 to 1.0 percent palladium in titanium-base alloys. Selectivity is improved by the presence of nitrate. Author

N69-20816 Harvard Univ., Cambridge, Mass.
ALTERNOSORPTION AND THE HETEROGENEOUS REACTION OF METHYL CHLORIDE WITH GERMANIUM
Keith Bruce Kester (Ph.D. Thesis) 1968 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-12910

Alternosorption is the term given to the method of influencing the sorption processes taking place at the surface of a semiconductor by the application of an alternating electric field. In order to test this method radiofrequency electric fields were applied to germanium ingot electrodes undergoing reaction with methyl chloride. These experiments were conducted using an AN/ART-13 radiofrequency transmitter with a frequency range of 2,000 to 18,000 megacycles. The reaction of germanium with methyl chloride to form dimethyldichlorogermane was chosen as a representative, relatively simple heterogeneous reaction involving a semiconductor. It was assumed that the reaction took place in a three-step sequence involving 1) dissociative absorption of the reactant molecules on the surface of the germanium, 2) interaction with the atoms of the surface (surface reaction) and 3) desorption of the product molecules. Dissert. Abstr.

N69-20817 Harvard Univ., Cambridge, Mass.
INTERNAL MOTION IN ORGANOSILICON POLYMERS
Frank Steven Model (Ph.D. Thesis) 1968 234 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-12911

Internal motion in a number of organosilicon polymers was studied by the technique of wideline NMR over the temperature range 77–400°K. An improved spectrometer, based on the marginal oscillator method and phase sensitive detection, is described. A series of three dimethylpolysilazanes, one a completely linear polymer, have been studied. A computer program, written to appraise elemental analyses, reveals that the chains in these polymers terminate primarily by ring formation. Wideline NMR data suggest that there is much internal motion in the silazanes at 77°K. Evidence is presented for the presence of rotation of the methyl groups about their C_3 axes, as well as rotation or torsional oscillation of the $Si(CH_3)_2$ groups about their Si–N bonds. Upon warming, additional motion, including chain translation and chain flexing or bending, is indicated. Dissert. Abstr.

N69-20818 Georgetown Univ., Washington, D. C.
FORMATION AND PROPERTIES OF REDUCED 2:18 HETERPOLY MOLYBDATES AND TUNGSTATES
Elias Papaconstantinou (Ph.D. Thesis) 1968 259 p
Avail: Univ. Microfilms: HC $11.70/Microfilm $3.35 Order No. 68-12810

The reduction stoichiometries, reduction potentials, and properties of the reduced products, of the following well-characterized 2:18 heteropoly anions, in acidic, neutral, and basic solution are reported: $[P_2W_{18}O_{62}]^{6-}$ (A-isomer), $[P_2W_{18}O_{62}]^{6-}$ (B-isomer), $[As_2W_{18}O_{62}]^{6-}$, $[P_2Mo_{18}O_{62}]^{6-}$, and $[As_2Mo_{18}O_{62}]^{6-}$. The reduction of $[PW_{12}O_{40}]^{3-}$ in basic solution is also reported and its behavior is compared with behaviors of the above anions. Potentiometric titration with various reducing agents, and polarography, showed that the 2:18 anions could accept at least six electrons without decomposition, producing blue products. Dissert. Abstr.

N69-20824*# National Bureau of Standards, Washington, D. C.
ELECTRODELESS ELECTROLYSIS OF SOLID ELECTROLYTES Semiannual Progress Report, 1 Nov. 1967–31 May 1968
Abner Brenner and John Sligh 1 Jun. 1968 9 p
(NASA Order-R-09-022-052)
(NASA-CR-100422; NBS-9869) Avail: CFSTI CSCL 07D

Glow discharge electrolysis of fused salts was investigated with preliminary results indicating that the process is normal electrolysis. The apparatus used is described, and the results discussed. In the glow discharge electrolysis of silver chloride, silver dendrites were obtained, appearing similar to those obtained in

electrolysis of a water solution. Electrolysis of an eutectic melt containing cuprous chloride yielded copper dendrites. It was shown that true electrolysis can be brought about without the contact of any solid electronic conductor with the electrolyte. P.A.B.

N69-20831 University of the Pacific, Stockton, Calif.
ELECTROCAPILLARY STUDIES OF REVERSIBLE CHANGE TRANSFER V(III)/V(II) ELECTRODE
Mohammad Ali Akhtar (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-11838

Electrocapillary equation for an ideal polarized electrode based on Gibb's adsorption equation is appropriately recast into experimentally measurable quantities in order to apply it to a reversible charge transfer electrode. To calculate the various parameters of the equation developed, experimental details were worked out. For the measurement of Current-time relationship of a single drop, a fast response potentiostat was built by using transistorized chopper stabilized operational amplifiers and precision components in the circuitry with proper compensation for IR-drop in the cell and the electrical double layer capacity. The analysis of I-t curves was done by taking into account the composite nature of the process involved; faradaic and non-faradaic. Dissert. Abstr.

N69-20832 Clemson Coll., S. C.
REACTION OF OXYGEN ATOMS WITH SOME SUBSTITUTED CYCLOPROPANES
John Hughes Reynolds, IV (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-13462

The object of the present research was to determine the relative reactivities of cyclopropane and some substituted cyclopropanes and to determine if possible some or all of the products of these reactions. The method of generation of the oxygen atoms was the mercury photosensitized decomposition of N_2O. It is generally accepted that this results in the production of $O(^3P)$ atoms. The reaction mixtures were analyzed gas chromatographically. Arrhenius activation energy differences and preexponential factor ratios were determined for cyclopropane, methyl cyclopropane, and 1,1-dimethyl cyclopropane from least squares treatment of the natural logarithms of the relative rate constants obtained at several different temperatures. Comparison of the rate data for the cyclopropanes with that for alkanes and alkenes indicated that cyclopropane and its simple derivatives are less reactive than either of these two types of compounds. Dissert. Abstr.

N69-20834 Illinois Univ., Urbana.
HIGH PRESSURE MOESSBAUER STUDIES ON IRON AND ITS DILUTE ALLOYS
Joseph Andrew Moyzis, Jr. (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-12168

The pressure dependence of the Mössbauer f number for ^{57}Fe in copper, vanadium, and titanium was studied. Values of the Debye parameter θ and the second inverse moment of the lattice spectrum for the host metals are obtained. The values of θ_{host} for copper, vanadium, and titanium are 309°K, 274°K, and 350°K respectively. The copper value is in excellent agreement with the values of the Debye parameter obtained in X-ray studies which are governed by the same Debye-Waller factor as in the Mössbauer f number. The titanium value is in good agreement with the Debye parameter obtained from room temperature specific heat measurements. For vanadium the value of θ_{host} is in agreement with Debye parameters obtained from specific heat measurements on lower purity vanadium samples and the purity-θ_{host} dependence found in specific heat measurements is also seen here. The values of $\langle\omega^{-2}\rangle$ for copper, vanadium, and titanium are 1.60×10^{-27} sec^2, 2.57×10^{-27} sec^2, 1.66×10^{-27} sec^2, respectively. Dissert. Abstr.

N69-20835 Texas Univ., Austin.
HALL EFFECT MEASUREMENTS OF THE METAL-NONMETAL TRANSITION IN LITHIUM-AMMONIA SOLUTIONS
Robert Dwight Nasby (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-10873

The Hall coefficient, the electrical conductivity, and their temperature dependences, were measured for lithium–ammonia solutions from 13.9 to 1.6MPM, where MPM denotes the solution concentration in 100 × (moles lithium)/(moles lithium + moles ammonia). The temperature range was from ≈240 to ≈200°K, with the exception that data was not taken in the miscibility gap. The Hall coefficient was determined using a double frequency method; the magnetic field at 60 Hz and the sample current at 570 Hz. For concentrated solutions, greater than ≈9MPM, the solutions were found to exhibit essentially metallic behavior: a free electron Hall coefficient and conductivities of the order found in liquid metals. The major discrepancies were: a small, but positive, temperature dependence of the conductivity, and a stronger dependence of the conductivity upon concentration than that predicted for a simple metal. Dissert. Abstr.

N69-20853*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY DEVELOPMENT OF SPECTROCHEMICAL ANALYSIS OF SUPERALLOYS WITH THE LIQUID-LAYER SOLID-SAMPLE SPARK TECHNIQUE
Ramon M. Barnes Washington Mar. 1969 23 p refs
(NASA-TM-X-1753) Avail: CFSTI CSCL 07D

A comparison study is made, for the spectrochemical analysis of cobalt-base superalloys, between the liquid-layer solid-sample spark technique and the conventional point-to-plane spark analysis in air. The changes of analytical concentration curves are indicated for alloying constituents of two developmental cobalt-base alloys, and correlation of the changes to preliminary microscopic, metallographic, and spectroscopic phenomena are hypothesized. Author

N69-20855 Purdue Univ., Lafayette, Ind.
HIGH-RESOLUTION FIELD-IONIZATION MASS SPECTROMETRY
Edward Martin Chait (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-12531

High-resolution mass spectrometry is an excellent method of determining the elemental composition of a compound. The unambiguous determination of the elemental composition of a compound is possible if the mass of the molecular ion can be measured with sufficient accuracy. The major limitation of the use of electron-impact mass spectrometry for this purpose is that many spectra show no molecular ion. Field-ionization, however, has been found to give abundant molecular ions for most organic compounds investigated. This research investigates the combination of field-ionization and high-resolution mass spectrometry as a solution to the problem of obtaining elemental compositions for molecules and is the first general study of the application of exact mass measurement techniques to field-ion spectra. Dissert. Abstr.

N69-20866 Yale Univ., New Haven, Conn.
PART A: CROSSED-BEAM STUDY OF A SIMPLE ION-MOLECULE REACTION. PART B: REACTION OF FREE CARBON ATOMS WITH CYCLIC HYDROCARBONS
Timothy Laurence Rose (Ph.D. Thesis) 1967 372 p
Avail: Univ. Microfilms: HC $16.90/Microfilm $4.75 Order No. 68-13195

Techniques have been developed for the crossed-beam study of certain simple reactions as a function of energy. An approximately

monoenergetic ion beam is crossed with a thermal molecular beam and ionic products are characterized as to their nature, angular distribution, translational energy and, by difference, internal energy. These measurements are made as a function of energy available in the center of mass system in the range 0.1–3 eV. The reaction of free carbon atoms with cyclopentadiene, benzene, and, to a lesser extent, cyclopentane and cyclopentene, have been studied. Carbon atoms in the form of C^{11} are produced by nuclear techniques. Such atoms are translationally "hot" species in one of the low-lying electronic states. In certain experiments, they are cooled to thermal energies by the addition of excess rare gas moderator. Products are formed on a tracer scale and are analyzed by radio gas chromatographic methods. Dissert. Abstr.

N69-20869 State Univ. of New York at Buffalo.
MONOMOLECULAR FILMS: FILMS OF PHOSPHOLIPIDS, AND FILMS ON AQUEOUS GLYCEROL SUBSTRATES
Richard Joseph Demchak (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-11520

Surface pressure and surface potential measurements as a function of the surface area/molecule have been obtained for various monomolecular films at the air–water interface. The studies involved synthetic materials, and were carried out in the temperature range of −7° to +37°C. It was concluded that film–film and film–substrate interactions had opposite effects on the isotherms of expanded films, and that both must be considered for a proper description of these films. By considering film–substrate interactions, an interpretation was given for the anomalous isotherms of films of saturated fatty-acid ethyl esters. Dissert. Abstr.

N69-20871*# Hercules Powder Co., Wilmington, Del. Research Center.
A STUDY OF THE MECHANISM OF CHEMICAL REACTIVITY OF NITROGEN TETROXIDE WITH TITANIUM ALLOY Quarterly Report, 1 Apr.–30 Jun. 1968
Albert Z. Connar 1 Nov. 1968 32 p
(Contract NAS8-21207)
(NASA-CR-98363; QR-4) Avail: CFSTI CSCL 07B

An additional eleven stress corrosion cracking (SCC) tests were performed. The main objective of the majority of these tests was to establish concentration levels of NO and protonated species that might be critical to the occurrence or inhibition of SCC. This work was made possible by the moderately successful scale-up of a laboratory dehydration unit for the production of 1 to 1.5 liters/hour of dried N_2O_4, and was added by a major analytical breakthrough in the measurement and characterization of the protonated species in N_2O_4. The test data showed a definite interdependency between combined NO and protonated species concentrations with regard to the production of SCC. Dehydrated samples of RR N_2O_4 caused cracking. The addition of 1,600 ppm. of 99% HNO_3 to dehydrated N_2O_4 did not change the cracking behavior. Additions of NO to dehydrated and normal RR N_2O_4 showed that the dehydrated samples required more NO (>500 ppm.) to inhibit SCC than did the normal samples (150–200 ppm.). Author

N69-20872 Columbia Univ., New York.
THERMAL CONDUCTIVITY OF ALKALI METAL VAPORS. 1. EXPERIMENTAL RESULTS ON CESIUM AND RUBIDIUM. 2. THEORETICAL PREDICTIONS OF THERMAL CONDUCTIVITY OF LITHIUM, SODIUM, POTASSIUM, RUBIDIUM AND CESIUM
Chai-sung Lee (Ph.D. Thesis) 1968 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-11720

The frequency response to alternating current of a fine wire surrounded by alkali metal vapor was studied theoretically and experimentally for determining the thermal conductivity of the vapor. Data were obtained for cesium and rubidium vapors at pressures from 0.0829 to 0.214 atm. A new method was employed of correcting for temperature jump and vapor volumetric heat capacity. In addition, the thermal conductivity of the alkali metal vapors was calculated by gas kinetic theory, including the effects of dimerization and heat of association. Good agreement between experiment and theory was obtained, considering the possible errors. The total probable experimental error is estimated at 5.1%, and the uncertainty in the theoretical analysis at about 25%. Reliability of the method is indicated by agreement with literature values for argon up to 1085°C. The standard error of the argon correlation is estimated at 1.6%. Dissert. Abstr.

N69-20877 Stanford Univ., Calif.
UNLOADING ZONES FOLLOWING MOVING PLASTIC ZONES WITHIN ELASTIC FIELDS
Frank Claude Weiler 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-11371

Two spherically symmetric problems are stated and solved to illustrate the essential differences between moving and stationary plastic zone problems. Both sphere problems have three zones and inside and outside radii a and b. Problem 1 consists of a plastic zone $[\alpha(t) \leq r \leq \beta(t)]$ moving radially outward leaving an unloading zone $[a \leq r \leq \alpha(t)]$ behind. The outer zone $[\beta(t) \leq r \leq b]$ is still elastic. The inner and outer radii $\alpha(t)$, $\beta(t)$ of the plastic zone are prescribed functions of time. The boundary force $p(\alpha)$ at $r = a$, and interface force $F(\alpha)$ at $r = \alpha$, necessary to maintain the moving plastic zone are found as part of the solution. Problem 2 consists of a stationary plastic zone $[\alpha \leq r \leq \beta]$, an outside elastic zone $[\beta \leq r \leq b]$ and an inside elastic zone $[a \leq r \leq \alpha]$. The boundary force $p^*(\alpha)$ at $r = a$ and interface force $F^*(\alpha)$ at $r = \alpha$ are again found as part of the solution. For the problem of the propagating crack, a complete system of field equations, interface conditions and boundary conditions was formulated. Dissert. Abstr.

N69-20878 Clarkson Coll. of Technology, Potsdam, N. Y.
SIMULATION OF A PACKED COLUMN
Walter George Mellish (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-11775

A model is described which may be used to simulate a packed column for countercurrent gas phase controlled absorption with liquid phase reaction. It has been found that the mass transfer coefficient for a packed column decreases by as much as 50 percent from start up to steady state, rises by as much as 100 percent with inlet reactant concentration for absorption with liquid phase reaction, and varies by as much as 50 per cent with inlet gas concentration for absorption with liquid phase reaction. It has also been found that the mass transfer rate of a column increases with the pulsing and controlled cycling of one or both phases. There have been no successful attempts to correlate all of these responses using one model for gas phase controlled absorption. The problem lies in the obtaining of consistent data and in the description of a model to simulate the system. A model is proposed consisting of a number of continuous stirred tank reactors in parallel with equal volumes and mass transfer areas. A distribution is presented which uses one parameter to determine the fraction of total liquid throughput going to each reactor. The model represents a previously proposed concept of liquid pockets, some of which are semistagnant during absorption. Dissert. Abstr.

N69-20886 Fordham Univ., New York.
KINETIC STUDIES ON THE OZONATION OF FLUORINE SUBSTITUTED HYDROCARBONS
Barbara Joan Drescher (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-11013

The reaction of ozonized-oxygen with fluorine-substituted hydrocarbons was studied using an infrared method of analysis. The change in concentration of ozone and products was followed by observing the change in absorption. The ozone harmonic was used to determine the concentration changes. The rate constants were calculated on the basis of a differential equation. Reaction mechanisms are presented for the compounds studied which can be used to explain the results. Dissert. Abstr.

N69-20887 Pennsylvania State Univ., University Park.
THE DETERMINATION OF THERMODYNAMIC PROPERTIES OF HOMOGENEOUS AND NON-HOMOGENEOUS SOLUTIONS BY ULTRASONIC MEASUREMENTS
William James Snyder (Ph.D. Thesis) 1967 247 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-12008

Sound velocities and densities were determined as a function of temperature from 0° to 65°C for hexane, methanol, benzene, and various mixtures of benzene in methanol, benzene in hexane and hexane in methanol. From the heat capacity, density, and sound velocity data, the adiabatic compressibility, isothermal compressibility, heat capacity at constant volume, the ratio of heat capacities, partial molar volume and partial molar sound velocity were calculated. The ratio of heat capacities was found to decrease with temperature, benzene having the highest temperature coefficient and methanol the lowest. In addition, the sound velocity of hexane was determined as a function of pressure (0–1200 psig) at 40°, 111°, and 180°C. Thermodynamic relations were developed for sound velocity and osmotic pressure, activity coefficients, and the temperature coefficient of sound velocity. Dissert. Abstr.

N69-20893 Stanford Univ., Stanford.
FAR INFRARED STUDIES OF IONS IN ALUMINUM AND MAGNESIUM OXIDES
Jacob Yau-man Wong (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-11375

The low lying energy levels of transition-metal ions in aluminum and magnesium oxides were studied by means of far infrared absorption spectroscopy with the use of a large grating spectrometer covering the range from 10 cm^{-1} to 220 cm^{-1}. The far infrared spectrum of $Al_2O_3:V^{4+}$, a $3d^1$ system, was measured. Levels were observed at 28.1 cm^{-1} and 52.8 cm^{-1} and interpreted as transitions from the ground state to the first two excited states of this system. The temperature dependent widths and shifts of these lines are analyzed in detail. As noted also in $Al_2O_3:Ti^{3+}$, another $3d^1$ system, the positions of the low lying energy levels of $Al_2O_3:V^{4+}$ do not agree with those predicted by static crystal field theory. A model in which only E_g vibrations are considered to interact with d^1 electronic systems has been developed which gives a satisfactory quantitative explanation of the low lying levels of both $Al_2O_3:V^{4+}$ and $Al_2O_3:Ti^{3+}$. Dissert. Abstr.

N69-20898*# Aztec School of Languages, Acton, Mass. Research Translation Div.
THE ABSORPTION OF LIGHT BY OXYGEN AT THE WAVELENGTH LAMBDA = 2144 Å AS A FUNCTION OF PRESSURE [DIE ABSORPTION DES LICHTES DURCH SAUERSTOFF BEI DER WELLENLAENGE LAMBDA = 2144 Å IN ABHAENGIGKEIT VOM DRUCK]
Walter Heilpern Washington NASA Mar. 1969 25 p refs Transl. into ENGLISH from Helv. Phys. Acta (Basel), v. 14, 1941 p 329–354
(Contract NASw-1892)
(NASA-TT-F-12107) Avail: CFSTI CSCL 07D

The absorption of light by oxygen in the area of its continuous absorption at the wavelength λ = 2144 Å for atmospheric pressure as well as for lessened pressure is studied. It was found that during absorption, the Beer Law is not fulfilled; pressure comes in with $p^{1.55}$. Moreover, the absorption of the light and oxygen-nitrogen mixtures at the same wavelength were determined. It was established that absorption of oxygen is increased by addition of nitrogen, although the latter by itself does not absorb in the studied wave area. Author

N69-20900 Pittsburgh Univ., Pa.
AN ANALYSIS OF NONISOTHERMAL MULTICOMPONENT DIFFUSION IN THE LIQUID PHASE
George Byers de Lancey (Ph.D. Thesis) 1967 276 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.55 Order No. 68-9740

The equations describing coupled heat and mass transfer in nonreactive chemical systems are cast into a form suitable for mathematical analysis. Sufficient conditions are presented for the existence of a nonsingular transformation that diagonalizes the transport coefficient matrix and uncouples the transport equations. A method is also presented for solving the transport equations for the reactive case. A time varying linear transformation is used to cast the transport equations into a system resembling the coupled diffusion equations with time dependent diffusion coefficients. The equations are shown to be solvable for a variety of special cases. Dissert. Abstr.

N69-20907 Hawaii Univ., Honolulu.
INFRARED SPECTROSCOPY AND COORDINATION CHEMISTRY
Surendra Nath Ghosh (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-11927

Infrared spectral(IR) study was undertaken to investigate the metal–nitrogen(M–N) and metal–halogen(M–X) bond vibration in about 70 complexes of Cr(III), Mn(II), Mn(III), Fe(II), Fe(III), Co(II), Ni(II), Cu(II), Zn(II), Pd(II), Cd(II), Sn(II), Sn(IV), and Hg(II) with 1,10–phenanthroline (phen) and 2,2–bipyridine(bipy) as ligands with regard to the effect of coordination number, oxidation state, anion and stereochemistry on those low bond order absorption bands in the low frequency side of IR. The steric hindrance of phen over bipy was also observed. The metal–halogen mode in divalent tetrahalometallate was assigned, discussed, and compared with protonated ligand. The thermal decomposition of these salts gave rise to four coordinated compounds with an anion going into the first coordination sphere. Dissert. Abstr.

N69-20934 Florida State Univ., Tallahassee.
NMR IN PARAMAGNETIC NdBr SUB 3 AND UI SUB 3 AND IN ANTIFERROMAGNETIC UI SUB 3
Stephen Ira Parks (Ph.D. Thesis) 1967 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11682

THE NMR spectra of $NdBr_3$ and UI_3 above the Neel temperature, and of UI_3 below the Neel temperature were measured and the dependence of frequency on temperature was analyzed. In UI_3 the line spectra were analyzed by a least-squares computer technique. At the C site e^2qQ/h = 365 MHz, η = 0.1537. The internal magnetic field H had a zero-temperature asympote of 14.1 kG at a direction θ = 89.07°, ϕ = 87.9°, with θ and ϕ measured from the V_{zz} and V_{xx} axes respectively. Two magnetically inequivalent F sites were observed: for both of them e^2qQ/h = 183 MHz and η = .7058; on site 1, H = 17.39 KG, θ = 57.65°, ϕ = 84.38°; on site 2, H = 17.41 KG, θ = 57.44°, and ϕ = 86.9°. The magnetization curve is abrupt: at 2.4°K (0.92 T_N) the sublattice magnetization is still greater than 92% of its zero-temperature asympote, indicating a very large anisotropy. In $NdBr_3$ the values for the C site at room temperature are e^2qQ/h = 89.076 MHz, η = .068; for the F site e^2qQ/h = 45.348 and η = .487. Dissert. Abstr.

N69-20958 Michigan Univ., Ann Arbor.
OPTIMAL OPERATION OF A TUBULAR CHEMICAL REACTOR
Mark Richard Newberger (Ph.D. Thesis) 1968 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-13369

A theoretical and experimental study was conducted on the optimal steady state operation of a jacketed tubular reactor in which two, consecutive, second order, homogeneous, liquid phase chemical reactions occurred in turbulent flow. The experimental phase of this research concerned the development of a satisfactory reactor model with the aid of measured concentration and temperature profiles. The mathematical model was utilized to predict optimal operating conditions. The theoretical phase of this research extends the literature on optimal constrained temperature and wall heat flux profiles in tubular reactors of fixed residence time. First and second order consecutive reactions were considered in which the activation energy of the first reaction was greater than that of the second. Using the Pontryagin Maximum Principle, temperature and heat flux profiles were determined which maximized the yield of middle product at the reactor exit. Dissert. Abstr.

N69-20960 Washington Univ., Seattle.
THE EFFECT OF SURFACE ACTIVE AGENTS ON LIQUID-LIQUID MASS TRANSFER RATES
Lyle Kennath Mudge (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-12707

An interferometric technique was used for the direct measurement of a barrier type resistance to the transfer of solute between immiscible liquid phases in the presence of surface active agents. The solutes that were employed in the study were n-butanol and isobutyl alcohol. The solute transferred from water, which contained either sodium tetradecyl sulfate or sodium dodecyl sulfate, to carbon tetrachloride. The results showed a resistance of considerable magnitude for the transfer of n-butanol. The approximate values of the resistance were 2300 sec/cm with an initial sodium tetradecyl sulfate concentration of 65 p.p.m., 1050 sec/cm with 2.5 p.p.m. of the same surfactant, and 900 sec/cm with 65 p.p.m. of sodium dodecyl sulfate. The resistance did not change significantly with a change in n-butanol concentration. The resistance for the transfer of isobutyl alcohol with an initial concentration of 65 p.p.m. sodium tetradecyl sulfate was less than 500 sec/cm. Dissert. Abstr.

N69-20966 Illinois Univ., Urbana.
CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS AND ANNEALING IN INORGANIC CRYSTALS
El-Hussieny Mohamed Mohamed Diefallah (Ph.D. Thesis) 1968 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-12104

The chemical effects of radiative neutron capture and associated radiation damage were investigated for Os^{191m} and Os^{193} produced in pure crystals of $K_4Os(CN)_6$ and $Ca_2Os(CN)_6$, as well as in isomorphous mixed crystals of the type $K_4Os(CN)_6$–$K_4Fe(CN)_6$ and $Ca_2Os(CN)_6$–$Ca_2Fe(CN)_6$. The chemical effects of the isomeric transition Os^{191m} (I.T.) Os^{191} were studied in crystals of pure $K_4Os(CN)_6$. High voltage paper electrophoresis was utilized for separation and identification of the chemical entities incorporating the hot atom and formed after dissolution of the neutron irradiated sample in 0.001 N HCl solution. Two osmium chemical states, OsO_2 and the parent $Os(CN)_6^{4-}$, were observed in this analysis. Individual retentions of Os^{191m} and Os^{193} were calculated from the experimental data obtained by assaying the radioactivity associated with the chemical species separated on the paper. Dissert. Abstr.

N69-20980 Iowa Univ., Iowa City.
A STUDY OF MEMBRANES FOR POTENTIAL INDICATING ELECTRODES
James Leonard Seago (Ph.D. Thesis) 1968 229 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-10690

The classes of barriers studied were metal foils, immiscible organic liquids and membrane matrices of collodion, paraffin, hot melt glue and silicone rubber. These latter matrices were impregnated with various insoluble transition metal compounds. A novel liquid barrier was fabricated with porous fluorocarbon separators. Acetylacetone and water immiscible liquids saturated with nickel and copper chelates were investigated as possible cationic sensitive liquid barriers. Transition metal ion indicating electrodes were developed by utilizing insoluble transition metal salts imbedded into silicone rubber membranes. These electrodes were found to possess suitable mechanical properties, but the desired selectivity was not attained. Dissert. Abstr.

N69-20982 Michigan State Univ., East Lansing.
STRUCTURAL AND PHASE INVESTIGATIONS: I: CRYSTAL STRUCTURE OF LANTHANUM CARBONATE. II: PHASE ANALYSES OF LANTHANIDE OXYGEN FLUORIDES
Dennis Burton Shinn (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-11086

The crystal structure of lanthanum carbonate octahydrate has been determined from an X-ray diffraction study of a single crystal specimen. Four formula units are contained in an orthorhombic unit cell. The space group is Pccn. The final R factor is 0.061 for three-dimensional counter data collected with CuK_α radiation. Crystallization results in an irregular layer structure in which the basic layer is formed by alternate rows of carbonates and metals. Hydrogen bonding is apparent. Lanthanide oxide fluorides have been studied with high temperature X-ray powder diffraction and differential thermal analysis techniques. They were found to undergo reversible transitions from rhombohedral to cubic symmetry in the temperature range 495 to 608°. The enantiotropic transition occurred with a 0.7–1.0% increase in volume. Dissert. Abstr.

N69-20985 Texas Univ., Austin.
THE INTERACTION OF OXYGEN AND WATER VAPOR WITH EVAPORATED ALUMINUM FILMS
Robert Charles Allen (Ph.D. Thesis) 1968 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-10804

The interaction of oxygen and water vapor with thin evaporated aluminum films (100 Å) was followed with a quartz crystal microbalance. It was found that surface areas of the films did not depend in any simple manner on the mass of the films but upon the nature of the films and upon the substrate. Residual gas analysis revealed that molecular hydrogen was the predominant outgassing product during the evaporation of the aluminum. Oxygen adsorption was studied at pressures from $\approx 10^{-6}$ to $\approx 10^{-3}$ Torr in order to follow monolayer formation conveniently. A rapid adsorption to the monolayer was observed, followed by a slower incorporative process. The reaction to form the monolayer was found to be activated to some degree, and the reaction order with respect to oxygen was found to be 0.4 ± .1. These results were explained on the basis of rearrangement of the surface metal atoms by a place exchange or similar process. Dissert. Abstr.

N69-20989 Ohio State Univ., Columbus.
GAS-PHASE REACTION KINETICS AND DIFFUSION IN MASSIVE MICROPOROUS CATALYSTS. 2. BROMOPROPANE AND POROUS VYCOR GLASS
Gerald Allen Wilcox (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-12886

The purpose of the investigation was to develop and utilize chemical reaction kinetics of a catalysis system for the study of internal diffusion of reacting gases in massive, well-defined, microporous catalysts. Particular attention is given to systems with significant adsorption and differences in surface affinity for the various reaction species. Oxygen-cleaned, unpromoted, porous Vycor glass, code 7930, was discovered as an effective dehydrobromination catalyst for several lower organic bromides. It is more effective with secondary than with normal bromides. Attention was focused on the catalyzed reaction, $C_3H_7Br \rightleftharpoons C_3H_6 + HBr$, at 170–260°C, 0.5–1.5 atm, and one mole product excess per mole reactant. One-eighth inch diameter porous Vycor rods were crushed to 140/200 mesh for kinetic data catalyst. Rods of the same batch were used for catalyst to obtain diffusionally controlled reaction data. Typical pore diameters for this type of porous Vycor are about 50 Å or about ten times the diameter of the reacting molecules. Dissert. Abstr.

N69-21035 Hawaii Univ., Honolulu.
A CHEMICAL STUDY OF HAWAIIAN VOLCANIC GASES
James Bruce Finlayson (Ph.D. Thesis) 1967 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-11926

A chemical study was made of volcanic gases from a variety of sources at Kilauea volcano on the island of Hawaii. During a recent flank eruption, gas samples were taken from the molten surface of a lava lake as it was forming in a pit crater. Additional samples were collected from fumeroles on the summit area of Kilauea, and the majority of these were taken at the piped fumerole of Sulfur Bank. The analysis of samples from all collecting sites showed varying degrees of air contamination. Investigations were made to determine its cause. The results of the investigation of the degassing of a large, isolated body of cooling lava showed a gradual depletion of the principle carbon and sulfur gases with time. Samples were also examined for compositional changes that might allow prediction of eruptions, as suggested by previous workers. The results of this research imply that the interpretation of the role played by the gas phase in volcanics would be greatly aided by more frequent and systematic sampling of volcanic gases. Dissert. Abstr.

N69-21045 Hawaii Univ., Honolulu.
ISOTOPIC FRACTIONATION IN HAWAIIAN VOLCANIC GASES
Larry Joe Moore (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-11938

A complete mass spectrometer was constructed around a mass spectrometer tube originally designed by Nier. Modifications of this single collector device permitted its use as a medium precision instrument in the determination of isotope abundances in carbon dioxide. In addition, a previous gas chromatograph design was modified to allow a one step separation and collection of carbon dioxide from a volcanic gas matrix, thus eliminating the usual and tedious volumetric method. To qualitatively predict the magnitude and direction of the isotopic fractionation in volcanic gases at higher temperatures (600°K to 1500°K), equilibrium constants were calculated for numerous reactions involving carbon or oxygen isotope exchanges, such as $1/2\text{-}C^{16}O_2 + H_2{}^{18}O = 1/2\text{-}C^{18}O_2 + H_2{}^{16}O$. The validity of these partition function calculations, which were based on Urey's simple harmoinc approximations, was checked by comparison with similar calculations utilizing high temperature anharmonic corrections. Dissert. Abstr.

N69-21055 Nebraska Univ., Lincoln.
THE HEAT SOLUTION OF HYDROGEN FLUORIDE
Walter William Rodenberg (Ph.D. Thesis) 1968 69 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-11567

The heat of solution of gaseous HF in aqueous NaOH at 25°C. was measured in two pressure ranges (315–350 mm. and 140–155 mm.) A special gas handling system was designed and constructed and new techniques evolved for calorimetric study of gas-liquid reactions below atmospheric pressure. Gas imperfection corrections were calculated from PVT data and heat capacity data. At 150 mm., the uncertainty in the gas imperfection ($H^\circ - H$) is about 20 cal./mole. The standard heat of solution of the ideal gas was determined to be -14.70 ± 0.10 kcal./mole. Dissert. Abstr.

N69-21057 South Carolina Univ., Columbia.
THE VIBRATIONAL SPECTRA AND STRUCTURE OF POLYATOMIC MOLECULES WHICH CONTAIN ANHARMONIC VIBRATIONS
William Harris Green (Ph.D. Thesis) 1967 226 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-3930

The Raman and far infrared spectra of diketene, beta-propiolactone, chlorocyclobutane, bromocyclobutane, and cyclobutanol have been investigated. The ring-puckering vibration was observed in the Raman spectrum of diketene at 144 cm^{-1}, of beta-propiolactone at 204 cm^{-1}, of chlorocyclobutane at 165 cm^{-1}, and of bromocyclobutane at 150 cm^{-1}. The vibrational spectra of four isotopic species of bromocyclobutane have been recorded. Assignments for the thirty fundamental vibrations have been presented, and support for the existence of equatorial and near-planar conformers has been obtained from a temperature study. Dissert. Abstr.

N69-21073# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
ON THE SYSTEM HYDRAZINIUM DIFLUORIDE-ZIRCONIUM TETRAFLUORIDE-WATER
M. Vilhar and J. Siftar Oct. 1968 6 p Presented at the 2nd European Symp. on Fluorine Chem., Goettingen, West Ger., 28–31 Aug. 1968
(NIJS-R-550) Avail: CFSTI

The system hydrazinium (+2) fluoride–zirconium tetrafluoride–water was investigated. The conditions for the formation of pure compounds were determined. Hydrolysis occurred whenever low concentrations of hydrazinium (+2) fluoride or hydrofluoric acid were employed at the synthesis. Analogous to the ammonium counterpart, the hydrolysis product has, according to its chemical analysis, infrared spectrum, and X-ray power diffraction pattern, a simple formula $(N_2H_5)_{1.9}H_{0.2}Zr_2F_8O.2HF$. Hydrazinium (+2) heptafluorozirconate and (+2) hexafluorozirconate thermally decompose in argon yielding above 400°C zirconium tetrafluoride. Author

N69-21076# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
SYNTHESIS OF HYDRAZINIUM (+2) FLUOROMAGNESATE
J. Slivnik, M. Zvanut, and B. Sedej Oct. 1968 6 p Presented at the 2nd European Symp. on Fluorine Chem., Goettingen, West Ger., 28–31 Aug. 1968
(NIJS-R-549) Avail: CFSTI

Magnesium carbonate reacts with the solution of hydrazinium (+2) fluoride in diluted hydrofluoric acid, mole ratio being $MgCO_3:N_2H_6F_2:HF = 1:2:2$, yielding a product with the composition $N_2H_4:Mg:F = 1:2:6$. The influence of the amounts of hydrazinium (+2) fluoride and hydrofluoric acid in the reaction on the reaction product was investigated. The mole ratio of two reactants was kept constant while the amount of the third one was varied. A simple formula $N_2H_6(MgF_3)_2$ has been assigned to the reaction product according to its chemical analysis, X-ray powder diffraction pattern and infrared spectrum. Hydrazinium (+2) fluoromagnesate starts to decompose at about 100°C. The decomposition ends at approximately 500°C yielding magnesium difluoride with a surface area of 6–12 m^2/g. Author

N69-21083 Minnesota Univ., Minneapolis.
OXYGEN-17 AND PROTON NUCLEAR MAGNETIC RESONANCE STUDIES ON SELECTED ORGANOMETALLIC COMPLEXES: STRUCTURE, HYDRATION AND LIABILITY OF AQUO CATIONS
Gary Edward Glass (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-12260

The hydration numbers of the $(CH_3)_3Pt(IV)$, $(NH_3)_2Pt(II)$ and Ga(III) aquo ions were determined by ^{17}O nuclear magnetic resonance. Integration and Dy(III) molal shift measurements showed that the molecular species present in solution are: $[(CH_3)_3Pt(OH_2)_3]^+$, $[(NH_3)_2Pt(OH_2)_2]^{2+}$, and $[Ga(OH_2)_6]^{3+}$. The ^{17}O solvent chemical shifts were measured from an external, enriched water sample and from $Cl^{17}O_4^-$ ion in the solutions, and were found to be linear functions of [Dy(III)], the indicating ion. Observations of the ^{17}O nuclear magnetic resonance line-width of aqueous solutions of several ions as a function of temperature permit the determination of rates and activation energies for the rapid exchange between solvent water molecules and water molecules coordinated to the diamagnetic ions. Dissert. Abstr.

N69-21101# Bonn Univ. (West Germany).
ON QUANTITATIVE ANALYSIS OF HIGH BOILING POLYPHENYL MIXTURES IN THE FIELD ION MASS-SPECTROMETER [ZUR QUANTITATIVEN ANALYSE HOCHSIEDENER POLYPHENYLGEMISCHE IM FELDIONEN-MASSENSPEKTROMETER] Final Report
H. D. Beckey, E. Hilt, and H. Krone Brussels EURATOM 1968 31 p In GERMAN; ENGLISH summary
(Contract EURATOM-285-66-4-ORGD)
(EUR-4194.D) Avail: CFSTI

The possibilities of field ion mass spectrometry for quantitative analysis of high boiling polyphenyl mixtures are considered. As a result field ionization fits the requirements of the group analysis of polyphenyl mixtures, since the mass spectra are very simple (no fragments with relative intensities > 1%) and the field ionization probabilities of the different polyphenyls are equal within limits of accuracy. Difficulties are connected with sample inlet to the mass spectrometer ion source. When using a high temperature gas inlet system remarkable thermal decomposition was observed. The vaporization of samples directly from a crucible into the ion source, which finally was applied, had to be combined with ion detection by a photoplate integration technique. Author

N69-21142 Wisconsin Univ., Madison.
STRUCTURAL CHEMISTRY OF SEVERAL ORGANOMETALLIC AND INORGANIC COMPLEXES
Richard Wayne Perry (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-10926

The crystal and molecular structures of five transition metal complexes were determined from three-dimensional single-crystal X-ray structural analyses. It is possible to compare the chromium-coordinated thiophene ring parameters with those of free thiophene. The deformation of the thiophene ring upon complexation with a $Cr(CO)_3$ species is used to interpret the bonding interactions between the chromium atom and thiophene ring. The structural determination of 1-benzoyloxy-π-allylcobalt dicarbonyl triphenylphosphine has provided an opportunity to study the geometry of an open allylic species in a pentacoordinated complex. Dissert. Abstr.

N69-21147# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
PRESSURE AND MOLE RATIO INFLUENCE ON THE SYNTHESIS OF ZENON FLUORIDES
J. Slivnik and A. Smalc Oct. 1968 5 p Presented at the EUCHEM Inorg. Fluorine Conf., Leicester, England, 10–12 Apr. 1967
(NIJS-R-547) Avail: CFSTI

The influence of temperature, pressure, and $Xe:F_2$ mole ratio on xenon-fluorine reaction was studied. Using 100 ml nickel reaction vessels and $Xe:F_2$ mole ratio 1:10 with the total pressure up to 33 atm at 22°C, it was found that the reaction product at 120°C is xenon difluoride, at 150°C tetrafluoride, and at 200°C hexafluoride. Author

N69-21155# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
HYDRAZINIUM FLUOROMETALLATES OF TITANIUM, ZIRCONIUM, HAFNIUM, VANADIUM AND CHROMIUM
J. Slivnik and B. Volavsek Oct. 1968 6 p Presented at the EUCHEM Inorg. Fluorine Conf., Leicester, England, 10–12 Apr. 1967
(NIJS-R-548) Avail: CFSTI

The isolation of the following hydrazinium fluorometalates is reported: $(N_2H_5)_2TiF_6$; $(N_2H_6)TiF_6$; $(N_2H_6)_2TiF_8$; $(N_2H_5)ZrF_5$; $(N_2H_6)_3Zr_2F_{14}$; $(N_2H_6)HfF_6$; $(N_2H_6)_3Hf_2F_{14}$; $(N_2H_5)_2VF_5$; and $(N_2H_6)_3CrF_6$. Preliminary results of the x-ray structural analysis of the isolated hydrazinium fluorotitanates and fluorozirconates are given. The difference between the $N_2H_5^+$ compounds and the $N_2H_6^{2+}$ compounds at the thermal decomposition is discussed and a new possibility of the synthesis of TiF_3 using hydraziniumdifluoride as a fluorinating agent is reported. Author

N69-21159# California Univ., Los Angeles. Dept. of Engineering.
MEASUREMENT OF Ar-Kr AND Ar^*-Kr INTEGRAL CROSS SECTIONS AT INTERMEDIATE ENERGIES WITH AN ARC-HEATED AERODYNAMICALLY ACCELERATED ATOM BEAM
Daniel H. Winicur Dec. 1968 141 p refs
(Grants NSF GK-580; NSF-GK-1854)
(PB-180940; Rept-68-64) Avail: CFSTI CSCL 7/4

Relative values of the integral collision cross sections of Ar–Kr and $Ar^*(^3P)$–Kr are reported as a function of relative velocity. These measurements were made using an arc-heated, aerodynamically accelerated argon atomic beam and a liquid-nitrogen-cooled, krypton-filled scattering chamber. The velocity dependence of the Ar–Kr cross-section is compared to that obtained from a semiclassical random-phase calculation based on the Kihara potential model. The ratio of the Ar–Kr and Ar^*–Kr integral cross sections is compared to the value obtained in the absence of repulsive interatomic forces. The electron-impact excitation cross section of argon is measured relative to the ionization cross section over the energy range from 60 to 100 eV. Author (USGRDR)

N69-21163 Texas A&M Univ., College Station.
PRESSURE-VOLUME-TEMPERATURE RELATIONSHIPS OF METHANOL GAS
Arvind Pandurang Kudchadker (Ph.D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-11463

A Burnett-type apparatus was used to obtain compressibility factors of methanol vapor at temperatures from 25° to 200°C at 25° intervals and at pressures below the saturation pressure at each temperature. The accuracy of measurements in the compressibilities was 0.1% or less from 25° to 175°C and 0.3% at 200°C. An elaborate graphical smoothing procedure was followed to obtain smoothed, internally consistent values of compressibility factors. These smoothed values were then used to calculate vapor volumes, Berlin virial coefficients, Stockmayer force constants, thermodynamic properties, and equilibrium constants of formation of dimers, trimers, and tetramers using Woolley's model. These equilibrium constants were then utilized to calculate the enthalpy and the entropy of polymerization for all the isomeric species. Using the appropriate data and equations, the mole fractions of the various polymeric species in the gaseous phase as a function of temperature and pressure were calculated. The compressibility factors were also used to test the polar correlation of Eubank and Smith. Dissert. Abstr.

N69-21187*# Aztec School of Languages Inc., Acton, Mass. Research Translation Div.
ON THIOFORMAMIDE [UEBER THIOFORMAMID]
Richard Willstaetter et al Washington NASA Mar. 1969 17 p refs Transl. into ENGLISH from Chem. Ber. (Weinheim), v. 42, 1909 p 1908–1922
(Contract NASw-1692)
(NASA-TT-F-12023) Avail: CFSTI CSCL 07C

A method is described which leads to various modes of preparation of pure thioformamide and subsequent formation of its hydrochloride, and the eventual dissociation of the hydrochloride. The dissociation process yields many compounds and substances; the methods of preparation and the physical characteristics of these substances are described in some detail. Author

N69-21195 Ohio State Univ., Columbus.
STEADY STATE ANALYSIS OF A POROUS FLOW-THROUGH ELECTRODE
Ronald Michael Kovach (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-12850

This dissertation examines, in light of the new technical developments in electrochemistry, new ways to utilize electro-organic reactions for possible industrial use. A proposal was made to study a packed bed type of electrochemical converter. More specifically, this work was to study the characteristics of a porous flow-through electrode functioning as an electrolysis unit for electro-organic synthesis. In particular, the electrode was designed as a differential reactor to obtain results on the mass transfer and electrochemical kinetic characteristics of a porous bed packed with 1/8 inch lead spheres. Maleic acid was chosen as an electrode active organic substance because of its sufficient solubility in aqueous solution and it undergoes no side reactions in the desired potential range. Electroreduction of maleic acid to succinic acid in aqueous H_2SO_4 was accomplished on lead (Pb). Dissert. Abstr.

N69-21205 Cornell Univ., Ithaca, N. Y.
ELECTRON SPIN SUSCEPTIBILITIES OF THE LIQUID BINARY ALKALI ALLOYS
Jack Alan Kaeck (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-11630

Measurements of the Knight shifts are reported of the liquid binary alkali metal alloys over the entire range of concentration of constituents for the alloys Na–Cs, K–Rb, K–Cs, and Rb. Interpretation of the measurements in all the alloys to give the electron spin susceptibility of those alkalis not previously measured are presented. New results for pure metals, in cgs volume units, are $\chi_p = 0.71 \times 10^{-6}$ for potassium and $\chi_p = 0.67 \times 10^{-6}$ for both rubidium and cesium. The interpretation of the Knight shifts of the alloys places the burden of the changes in the Knight shift on changes in the atomic volume. (This Knight shift change amounts to as much as 65 G for an applied field of 10 kG in 10 atomic % Cs in Na–Cs.) The values are based upon the measured value $\chi_p = 0.95 \times 10^{-6}$ for sodium as a calibration point. Dissert. Abstr.

N69-21216 Washington Univ., Seattle.
A REDETERMINATION OF THE CRYSTAL STRUCTURE OF BIS-SALICYLALDIMINATO NICKEL(II) AND A STUDY OF WEIGHTING IN LEAST SQUARES REFINEMENT OF CRYSTAL STRUCTURES
Fay Lynnette Endres Pullen (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-12711

The crystal structure of bis-salicylaldiminato nickel(II) has been redetermined from three-dimensional X-ray data taken from integrated Weissenberg photographs. The space group is $P2_1/c$ with $Z = 2$ and unit cell dimensions $a = 12.921$, $b = 5.8356$, $c = 8.1048$ A, and $\beta = 95.518°$ obtained from counter data. The molecule is planar with no significant difference between the Ni–N and Ni–O bond distances (1.846 and 1.838 A respectively). Full-matrix least-squares refinements were carried out with six different weighting schemes, all of which led to conventional R's of about .064. The weights used were unit weights, Hughes weights, DELSIG weights (obtained from a plot of average ΔF against average F_o), and three others based on different empirical assessments of the variances of individual observations. The results of the refinement with unit weights are significantly different from the results with the other five weighting schemes. Dissert. Abstr.

N69-21217*# Aztec School of Languages Inc., Acton, Mass. Research Translation Div.
ON BENZOYLENE-BENZIMIDAZOLE [UEBER BENZOYLEN-BENZIMIDAZOLE]
H. Rupe et al Washington NASA Mar. 1969 19 p refs Transl. into ENGLISH from Chem. Ber. (Weinheim), v. 42, 1909 p 4287–4305
(Contract NASw-1692)
(NASA-TT-F-12024) Avail: CFSTI CSCL 07C

Preparation of benzoylene benzimidazole from o-phthalaldehyde and o-phenylendiamine is reported. The authors propose improved methods of preparing the benzoylene benzimidazole, and go more deeply into methods of preparing various derivatives of the latter. Author

N69-21219# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
THYROID BIOCHEMISTRY: STUDIES OF IODINASE AND THYROXIDASE [BIOQUIMICA TIROIDEA: ESTUDIOS SOBRE YODINASA Y TIROXIDASA]
N. Altschuler, H. Niepomniszeze and M. A. Disarev 1968 14 p refs In SPANISH; ENGLISH summary
(CNEA-227) Avail: CFSTI

Two preparations with peroxidasic enzymatic activities were separated starting from dog thyroid homogenates, one able to peroxidate iodide (iodinase), as measured spectrophotometrically at 287.5 mμ, and the other, using iodotyrosines as substrate, with activity at 328 mμ (thyroxidase). Incubations were done with preparations having thyroxidase activity in the presence of MIT-^{131}I, and paper chromatographies were developed with two solvent systems: methanol: ammonium acetate and butanol: ethanol: ammonium hydroxide. The incubations carried out with H_2O_2 showed the formation of an unknown compound, D', which has radioactivity and gives a positive non-hydrine reaction. The compound D' had 4–5% of the total radioactivity of each chromatogram. This compound was not observed when the incubations were done without H_2O_2. Electrophoretic runs in polyacrylamide gel were performed and stained with amidoschwarz and bencidine. The preparation of thyroxidase showed two bands, both with peroxidasic activity, one corresponding to canine hemoglobine and the other one to the enzyme. Author

N69-21242*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ON THE EXISTENCE OF IMINOETHER ARISING FROM HYDROCYANIC ACID [UEBER DIE EXISTENZ DER AUS DER BLAUSAURE ENTSTEHENDEN IMIDOATHER]
A. Pinner Washington NASA Mar. 1969 6 p ref Transl. into ENGLISH from Ber. Deut. Chemischen Ges. (Germany), v. 28, 1895 p 2454–2458
(Contract NASw-1692)
(NASA-TT-F-12019) Avail: CFSTI CSCL 07C

An assertion that hydrochloric formiminoethyl does not exist is refuted. The proofs for the nonexistence of the hydrochloric formiminoethers are recounted. The qualitative and quantitative analyses and decomposition reactions of the iminoether are discussed taking into account the pros and cons of the existence of the compound from hydrocyanic acid. B.P.

N69-21245*# Aztec School of Languages Inc., Acton, Mass. Research Translation Div.
THE CHEMISTRY OF CYANOGENS AND ISOCYANOGENS [DIE CHEMIE DES CYANS UND DES ISOCYANS]
J. U. Nef Washington NASA Mar. 1969 20 p refs Transl. into ENGLISH from Ann. Chem. (Weinheim), v. 287, 1895 p 337–359
(Contract NASw-1692)
(NASA-TT-F-12045) Avail: CFSTI CSCL 07C

The chemical reactions relating to certain cyanogens and isocyanogens, their preparation and reduction, intermediate compounds, and properties are presented in detail. Imidoformylcyanide is discussed along with its relation to dried hydrogen chloride in an absolute ethereal solution. It is determined that so-called salts from the reactions of hydrocyanic acid with hydrohalic acids are derivatives of imidoformylcyanide. The effects of hydrochloric acid on hydrocyanic acid, with or without alcohol, are described and the resulting hydrochloric salts are identified. The relations of hydrocyanic acid with acetyl bromine, aldehyde, and ketone are discussed. It is shown that there is no tautomerism in hydrocyanic acid or its salts. The behavior of unsaturated compounds during polymerization is also described. N.E.N.

N69-21252 Washington Univ., Seattle.
THE SYNTHESIS AND CHARACTERIZATION OF SOME METHYLTETRABORANES AND BISTRIFLUOROPHOSPHINE DIBORANE(4)
William Ray Deever (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-12684

Four methyl derivatives of tetraborane, 2-methyl tetraborane, 2,4-dimethyl tetraborane, 1,2-dimethyl tetraborane, and 2,2-dimethyl tetraborane were synthesized by treating dimethyl ether triborane(7) with 1,2-dimethyl diborane. These methyl derivatives were characterized by their ir spectra, mass spectra, nmr spectra, and melting points. Monoisotopic mass spectra were calculated for each of the dimethyl tetraboranes; showing each compound to be pure and to have as the correct formula the one assigned. It was found that abundance ratios of selected peaks in the high resolution mass spectra could be used to distinguish between 2,4- and 1,2-dimethyl tetraborane. The ^{11}B nmr enabled the locations of the methyl groups to be established. The nmr data showed the methyl groups to be electron withdrawing. Correlations were found between the number of methyl groups, and the chemical shifts and the coupling constants. Dissert. Abstr.

N69-21258 Hawaii Univ., Honolulu.
CATION ANALYSIS BY THIN-LAYER CHROMATOGRAPHY AND REFLECTANCE SPECTROSCOPY
David F. Zaye (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-11943

A procedure whereby reflectance spectroscopy can be employed for the analysis of substances resolved on thin-layer plates was developed with the use of metal cation mixtures that had been separated on cellulose plates. A rapid method was devised whereby fourteen cations were separated and identified in situ by their reflectance spectra after chromogenesis with a mixture of dithizone and 8-hydroxyquinoline. Subsequent treatment of the complexes with ammonia gave a second set of spectra for each ion so that unequivocal identification could be made in each case. Further studies were carried out on three of these cations: copper, nickel, and zinc. Copper and nickel were determined in the presence of eleven other cations without experiencing any interference by employing neocuproine and dimethylglyoxime, respectively, as chromogenic reagents. Dissert. Abstr.

N69-21269 California Univ., Los Angeles.
SPECTROSCOPIC AND CRYSTALLOGRAPHIC STUDIES ON METAL CARBONYLS
Robert Bau (Ph.D. Thesis) 1968 285 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.70 Order No. 68-12459

Partial vibrational analyses for a series of metal carbonyl compounds have been carried out, using an energy-factored model in which the carbonyl stretching modes were treated as isolated vibrations. ^{13}CO satellite bands were used to provide additional data for the calculation of force constants. The compounds studied were $M(CO)_5X$ (M–Mn,Re; X = H,D,Cl, Br,I), $Re_2(CO)_{10}$ and $Ir_4(CO)_{12}$. The intensities of these molecules have also been investigated. The results of this work were applied in the following manner: (1) To calculate the frequencies and intensities of further isotopically-substituted molecules. These predicted frequencies were subsequently confirmed by ^{13}CO exchange reactions. (2) To use these calculated frequencies and intensities to follow qualitatively and quantitatively the stereochemical fate of ^{13}CO exchange reactions. Dissert. Abstr.

N69-21274# Battelle Inst., Frankfurt Am Main (West Germany).
SUBSTITUTED CYCLOOLEFINS AND PARTIALLY HYDROGENATED BIPHENYLS
S. Sandroni (EURATOM), C. Beaudet (SERAI), and G. Juppe (EURATOM) Brussels EURATOM 1969 27 p refs
(Contract EURATOM-295-61-10-ORGC)
(EUR-4215.e) Avail: CFSTI

For a better understanding of the pyrolytic and radiolytic behavior of partially hydrogenated polyphenyls larger amounts of high purity 1-phenyl cyclohexene, 3-phenyl cyclohexene, 4-phenyl cyclohexene, 1-, 3- and 4-methyl cyclohexene, 1-methyl cyclopentene, 1-methyl cycloheptene, 1,3- and 1,4-cyclo hexadienes were synthesized and the compounds characterized by their ultraviolet, infrared, Raman, and nuclear magnetic resonance absorptions. From spectral correlations a 2,5-phenyl cyclohexadiene structure was assigned to the Birch reduction product of biphenyl with sodium. Author

N69-21280# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
CONSTRUCTION AND REACTIONS OF β PERFLUOROALKYL ALAMINES [DARSTELLUNG UND REAKTIONEN VON β-PERFLUORALKYL ALANINEN]
Hans-Ulrich Heininger (Ph.D. Thesis) 1968 93 p refs In GERMAN
Avail: CFSTI

Hydrogenolysis of 2-methyl 5-perfluoroalkyl carbonic acid ethyl ester to β-perfluoroalkyl N acetyl alanin ethyl ester represents a general method for β-perfluoroalkyl alanins synthesis. Reactions of β-perfluoroalkyl alanine with dehydrating reagents gave the corresponding pseudooxazol-5-one with double ring bonds between the N_3 and C_4 atoms. Transl. by G.C.

N69-21293# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
HYDRAZINIUM (+2) HEXAFLUOROMETALATES (IV) AND –(V)
B. Friec Oct. 1968 10 p Presented at the 2nd European Symp. on Fluorine Chem., Goettingen, West Ger., 28–31 Aug. 1968
(NIJS-R-551) Avail: CFSTI

Metal hexafluorides react with hydrazinium (+2) fluoride in HF at room temperature yielding complex fluorides of the type $N_2H_6(MF_6)_2$ and $N_2H_6MF_6$, where M = Mo, Tc, Re, or Os, depending on which reactant is used in excess. No reaction occurs with tungsten hexafluoride, whereas uranium hexafluoride forms at room temperatures only bishexafluorouranate (V) and at 0°C hydrazinium (+2) heptafluorouranate (V). Vanadium pentafluoride

reacts over an unstable intermediate to form eventually vanadium tetrafluoride. The $N_2H_6MF_6$ (M = Mo, Tc, Re) complexes are of body centered cubic symmetry with with a_0 = 10.55, 10.48, and 10.49 Å, respectively. The other compounds are of lower symmetry. The end products of the thermal decompositions of these materials are the metals for transition metal complexes and for uranium complexes, the tetrafluoride. For the tetravalent transition metal compounds, reduction is quantitative, while for the pentavalent compounds only partial recovery of the metals was observed owing to the volatilization of unknown intermediate products. Author

N69-21299# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

THE INFLUENCE OF GRAPHITE ON FOULING [EFFET DU GRAPHITE SUR L'ENCRASSEMENT]

M. Hoepper, F. Diletti, and F. Van Rutten Brussels 1968 22 p refs In FRENCH; ENGLISH summary

(EUR-4096-F) Avail: CFSTI

A study of the reaction between $FeCl_3$ and terphenyl allowed a possible explanation of fouling in the presence of chlorine. The graphite acts as a catalyst for the fouling reaction on its own surface and consequently decreases the deposition on hotter parts of organic circuits. Author

N69-21312# Washington Univ., Seattle. Dept. of Chemistry.

COMPETITIVE UNIMOLECULAR DECOMPOSITION OF ALKYL RADICALS

C. W. Larson, E. A. Hardwidge, and B. S. Rabinovitch 1 Jan. 1969 8 p refs

(Contract Nonr-477(36))

(AD-681049; TR-12) Avail: CFSTI CSCL 7/4

Detailed study was made of the competitive unimolecular decomposition of chemically activated 3,5,5-trimethylhexyl-2 radicals. These decompose by C-C bond ruptures to give neopentyl and methyl radicals. Disproportionation-recombination ratios of the various radicals were measured. The value of D(o) (neo-Pe-H) is determined to be 98.8 kcal/mole. The rate data are examined on a theoretical model. A summary of bond dissociation values determined by the present method is given. Author (TAB)

N69-21331# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).

THE FILTRATION OF AEROSOLS BY GLASS FIBRE FILTERS. 2: INFLUENCE OF THE LINEAR FLOW VELOCITY, THE AEROSOL LOAD, THE FILTER POROSITY AND THE AEROSOL MATERIAL [DE FILTRATIE VAN AEROSOLEN DOOR GLASVEZEL-FILTERS. 2: DE INVLOED VAN DE DOORVOER-SNELHEID, DE BELADING, DE POROSITEIT VAN HET FILTER EN DE AEROSOL STOF OP DE PENETRATIE]

J. F. van der Wal Sep. 1968 21 p refs In DUTCH; ENGLISH summary

(TDCK-52185-III; Rapt-1968-18) Avail: CFSTI

The influence of some parameters on the penetration of aerosols through glass fibre filters is described. It is concluded that the penetration decreases as the linear flow velocity decreases within the range of 0,1–1 cm/sec. The influence of the aerosol load on glass fibre filters is more pronounced for solid particles than for liquid particles, concerning both the penetration and the air flow resistance. Results indicate that the published relation of the filter thickness and porosity with the penetration -log $Pen \sim L(1-\epsilon)^2/\epsilon$ does not appear to be justified. The penetration is influenced by the chemical composition of the aerosol. Author

N69-21350*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.

SILICON SURFACE PASSIVATION FOR DEVICES Quarterly Status Report

Alan B. Kuper 1 Mar. 1969 12 p refs

(Grant NGR-36-003-067)

(NASA-CR-100497; QSR-2) Avail: CFSTI CSCL 07D

Water contamination in thermal oxide on Si in connection with device process control and reliability was studied. Water-related species, such as OH, have been found to be present in thermal oxide on Si. Radioactive water has been used to controllably hydrate conventional thermal oxide under conditions approximating device operation. Oxides were wet-grown at 1200°C to 5400 Å on 10 ohm–cm n-type Si wafers and baked in dry nitrogen for 30 min. at 1000°C. Samples were hydrated with tritiated water vapor (250 mC/gm specific activity) in an evacuated cell at controlled temperature, pressure, and time. Temperatures ranged from 50° to 250°C, times from 15 min. to 8 hrs., and water vapor pressures from 25 to 400 mm Hg (partial pressure of 25 mm of water vapor in air corresponds to relative humidity of approximately 70% at 90°F). Metal oxide semiconductor electrical measurements were made using evaporated Al dots and back contact. Hydrogen profiles were obtained by dilute HF etch-sectioning of oxide and liquid scintillation counting etchant. Author

N69-21359# Technological Lab. RVO-TNO, Rijswijk (Netherlands).

GAS CHROMATOGRAPHIC ANALYSIS OF GAS MIXTURES EVOLVING FROM PROPELLANTS DURING AGING

27 Sep. 1968 21 p refs

(TL-1968-15) Avail: CFSTI

Propellants decompose slowly on aging. This is accompanied by the formation of a number of gaseous products. If a propellant is in contact with air during aging, the gas mixture may also contain O_2 and Ar. When a propellant contains chlorine compounds (e.g. composite propellants) then a few more products could occur. Although composite propellants have a great stability, the formation of HCl, Cl_2, NOCl and possibly NO_2Cl could take place when stored at elevated temperatures. Apart from most of the before mentioned products also CH_4 could be developed when a propellant deflagrates. In case the propellant contains chlorine compounds, also $COCl_2$ has to be reckoned with. With the exception of NO and O_2 all these gases can occur independently. In order to be able to perform a quantitative analysis one must have the possibility to separate completely all components formed. Author

N69-21364# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.

HEAT CAPACITY OF LINEAR HIGH POLYMERS

Bernhard Wunderlich Nov. 1968 54 p refs Submitted for publication

(Contract Nonr-591(19))

(AD-681045; TR-17) Avail: CFSTI CSCL 7/4

All available data on heat capacities of linear high polymers have been critically reviewed and discussed in terms of the vibrational frequency spectrum. Several characteristic temperature regions could be delineated. Below 50K the heat capacity is conformation, crystallinity, and defect dependent. For crystalline polymer a T3 temperature dependence is generally found below 10K. Above 50K up to the glass transition temperature the heat capacity is largely independent of conformation crystallinity and defects. The absolute value of the heat capacity is largely additive from contributions of the chain atoms. The increase of heat capacity at the glass transition temperature of amorphous polymers is constant if calculated per mole of mobile bead. Between the glass transition and melting transition of semicrystalline polymers uncertainties arise due to instabilities of the metastable crystals. Melting behavior has been briefly reviewed. The heat capacities of the melt have been discussed where available. Only for polyethylene could a detailed interpretation be given. Author (TAB)

N69-21372# Aktiebolaget Atomenergi, Stockholm (Sweden).
PHASE DIAGRAMS OF SOME SODIUM AND POTASSIUM SALTS IN LIGHT AND HEAVY WATER
Karl Erik Holmberg Dec. 1968 48 p refs Submitted for publication
(AE-340) Avail: CFSTI

Phase diagrams for fluorides, chlorides, bromides, iodides, nitrates, sulphates and carbonates of sodium and potassium with D_2O and H_2O have been determined in the range from eutectic temperature to 60°C. Generally the relative solubility is less in D_2O, but there are some exceptions in cases of a hydrate as the solid phase. The freezing point depression for freezing of ice is often somewhat smaller in the case of D_2O. Author (ESRO)

N69-21377 Michigan State Univ., East Lansing.
HIGH TEMPERATURE MASS SPECTROMETRY: SAMARIUM DICARBIDE AND NEODYMIUM(III) MONOTELLURO OXIDE
Philip Anthony Pilato (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-11087

Samarium dicarbide was prepared from stoichiometric mixtures of samarium metal and graphite powder by heating in a sealed tantalum bomb. Analysis on three different preparations gave the following mole percentages: samarium, 32.72 ± 0.57% (calc., 33.33%); bound carbon, 67.28 ± 0.57% (calc., 66.67%). In a separate analysis 99.53% of the total sample weight was accounted for. The purity of neodymium samples prepared by passing tellurium vapor over Nd_2O_3 using hydrogen as the carrier gas was 99.6, 98.3 and 100.3% according to mass uptake data. X-ray powder diffraction analyses of the residues after vaporization indicated the compound vaporized incongruently to the sesquioxide. Mass spectrometric analysis of the effusing vapor is temperature dependent changing from less than to greater than unity at about 2150°K. Dissert. Abstr.

N69-21379 Illinois Univ., Urbana.
ALKALI METAL-HALOGEN INTERACTIONS IN THE SENSITIZED FLAME IONIZATION/FLAME PHOTOMETRIC DETECTOR
Jon Michael Baldwin (Ph.D. Thesis) 1968 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-12076

The mechanism of the halogen sensitized flame detector, commonly called the sodium thermionic detector, was investigated via kinetic studies based on atomic emission, atomic absorption and electrical conductivity measurements. The results of this study have led to the proposal of a mechanism involving ion pair production via charge exchange between the alkali metal and the halogen as the rate determining step. This reaction, in combination with faster balanced reactions relating the concentrations of negative halogen ions and electrons and of halogen atoms and the hydrogen acid of the halogen, produces an overall mechanism in which the halogen is involved as a catalyst. Dissert. Abstr.

N69-21416# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
THE ANALYSIS OF ADSORPTION ISOTHERMS OF VAPOURS ON HOMOGENEOUS SURFACES
J. G. T. van Aken Jun. 1968 33 p refs
(REPT-1968-11; TDCK-51368-III) Avail: CFSTI

The adsorption isotherms in the monolayer region of various substances on the homogeneous surface of graphitized carbon blacks were fitted to the isotherm equation, derived from the two-dimensional analog of the Van der Waals' equation of state. The adsorbent–adsorbate interaction constant, the monolayer capacity, and the lateral interaction constant, obtained from the matching procedure, offered the following information. The assumption of mobile adsorption, made in the derivation of the isotherm equation, proved to be correct, even for the case of benzene adsorption, for which localized adsorption was postulated in the literature. The surface areas, obtained from the values of the monolayer capacity of the various substances, agreed fairly well with each other. The lateral interaction between the molecules in the adsorbed phase was smaller than the mutual interaction in the gas phase, which phenomenon could be explained by the difference in the translation, rotation and vibration of the molecules in the two phases. Author

N69-21458# Technische Hochschule Munchen (West Germany).
KINETICS OF EXTRACTION OF METALS WITH ORGANOPHOSPHORUS COMPOUNDS [UEBER DIE EXTRAKTIONSKINETIK VON PLUTONIUM(4) UND URAN(6) IM PUREX-PROZE β]
Lorenz Finsterwalder [1968] 28 p refs Presented at the Intern. Conf. on Coord. Chem., Jerusalem, 1968
Avail: CFSTI

The mechanism of the extraction process, in respect to the chemical steps leading to the equilibrium state, as disclosed by kinetic measurement is discussed. The chemical kinetics at the interface is explained in terms of mass transfer, and metal extraction with organophosphorus compounds are considered favorable chemical condition to study. Specifically, the extraction of uranium from an aqueous solution into a hydrocarbon solution of tributylphosphate is detailed. Charts showing transfer rates of reactions are included. F.O.S.

N69-21479# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
INVESTIGATIONS OF REACTION KINETICS IN THE Xe–F_2 SYSTEM [UNTERSUCHUNGEN DER REAKTIONSKINETIK IM SYSTEM Xe/F_2]
J. Slivnik, and B. Zemva Oct. 1968 9 p refs In GERMAN
(NIJS-R-546) Avail: CFSTI

The time dependence of pressure for xenon–fluorine mixtures was measured at constant temperature. Copper or nickel reaction vessels were used in this invectigation. Starting mole ratios Xe : F_2 were 1:10 and 1:5 with a total pressure amounting 33 atm at room temperature. The measurements were carried out at 110°, 120° and 130°C. The experimental data treated with a computer show that the reaction differs from the reaction rate in the rest of the reaction time. The reaction was found in its second part to be of the first order in respect to xenon when mole ratios 1:5 and 1:10 and reaction temperatures 110° and 120°C were employed. Further investigations are under way. Author

N69-21518# National Bureau of Standards, Washington, D. C. Institute for Materials Research.
ACID-BASE BEHAVIOR IN APROTIC ORGANIC SOLVENTS
Marion Maclaan Davis Aug. 1968 158 p refs
(NBS-Monograph-105) Avail: SOD $2.25

Evidence given to support this picture includes data pertaining to colligative properties of acids, bases, and salts and also conductance, dielectric constants, distribution between immiscible solvents, and spectral absorption in the infrared, visible, and ultraviolet. The acids upon which attention is centered are proton-donor compounds that are measurably ionized in water. The bases of principal interest are likewise compounds capable of forming ions in water, for example, aliphatic and aromatic amines and derivatives of guanidine or pyridine. The solvents emphasized are hydrocarbons and halohydrocarbons, but data for dipolar aprotic solvents are included. Contrasts in acid-base behavior and in acidity and basicity scales in aprotic and water-like solvents are discussed. The role of hydrogen bonding in aprotic solvents is discussed at length. Important types of hydrogen-bonded structures include chelate rings; self-associated acids, bases, and salts; hydrogen-bonded ion pairs; and homo- and heteroconjugate cations and anions. Examples are given in which hydrogen bonding of these types affects such properties as the absorption spectrum of a salt, the catalytic effect of an acid, and the accurate location of a titration endpoint. Author

N69-21546*# Singer-General Precision, Inc., Little Falls, N. J. Aerospace Research Center.

THERMOCHROMIC DISPLAY MATERIALS FOR USE UNDER WIDE VARIATIONS IN AMBIENT ILLUMINATION LEVELS Final Report

William L. Flint, Daniel Grafstein, and Jehuda Menczel 31 Jan. 1969 86 p refs

(Contract NAS12-89)

(NASA-CR-86136) Avail: CFSTI CSCL 07D

The results of a program to synthesize inorganic thermochromic materials and to utilize them in display devic s insensitive to the effects of high ambient illumination levels are summarized. Four general categories of materials have been synthesized, all of which can provide rapid and reversible color changes as a result of either an order–disorder reaction or a change of lattice spacing. Applications which have been studied have included: (1) the use of localized electrical heating to provide a numeric indicator; (2) the use of thermochromics in a cathode ray tube, wherein writing is accomplished by the thermal energy in an electron beam; (3) laser writing on thermochromics; (4) the use of combinations of thermochromics with electroluminescent phosphors to produce a display readable under all conditions of ambient illumination; and (5) the use of thermochromic materials as a computer input device. This research has also made possible the development of a display of the output of a fluidic system. Several sealed cathode ray tubes have been fabricated and are designed to produce phosphor fluorescence when the electron beam strikes the phosphor. Author

N69-21563# California Univ., Los Angeles Dept. of Physics.

STUDY OF THE ENERGY DEPENDENCE OF ELECTRON-ION RECOMBINATION IN NITROGEN BY AN ION BEAM TECHNIQUE Final Report, 1 Apr. 1965–31 Mar. 1968

Gunter Hagen (Ph.D. Thesis) 31 Mar. 1968 123 p refs

(Contract AF 19(628)-4388)

(AD-681823; AFCRL-68-0649) Avail: CFSTI CSCL 7/4

A collinear electron-ion beam technique has been developed for measuring absolute cross sections of electron-ion reactions at low interaction energies. As an example of this technique, absolute recombination cross sections have been measured for diatomic molecular nitrogen ions and electrons over an energy range of 0.1 to 5 eV. It is found that the recombination coefficient is essentially independent of the interaction energy from 0.1 to 0.6 eV. The results are consistent with the assumption that dissociative recombination is the dominant recombination process. The experimental technique consists of merging a fast mass and energy analyzed ion beam with a collinear electron beam in a well defined collision volume and detecting the emergent energetic neutral particles resulting from the recombination reaction by kinetic ejection of secondary electrons at a tungsten dynode of a magnetic electron multiplier. Synchronous digital data averaging was used for signal-to-noise ratio enhancement, and high speed digital computer data processing was used for data reduction to obtain the recombination coefficient and the recombination cross section as a function of the interaction energy. Author (TAB)

N69-21566# Vanderbilt Univ., Nashville, Tenn.

HIGH RESOLUTION ELECTRONIC SPECTRA OF INORGANIC MOLECULES. THE STRUCTURE AND SPECTRUM OF CHLORINE DIOXIDE Final Report, 1 Jan. 1967–31 Dec. 1968

J. C. D. Brand, R. W. Redding, and A. W. Richardson Jan. 1969 32 p refs

(Grants DA-ARO(D)-31-124-G952; DA-ARO(D)-31-124-G771)

(AD-681936; AROD-6164.5-C) Avail: CFSTI CSCL 7/4

Bands of the 4750 A system of chlorine dioxide have been analyzed rotationally. Results from the well-resolved sub-bands establish that these are parallel bands and hence, as the ground state is known from microwaves to be 2B1, that the excited state is 2A2. The transition (100) - (000) analyzed in most detail has ν(o) = 21722/cm and gives the upper state rotational constants. Quadratic, cubic and quartic potential constants have also been obtained for the 2A2 state. The cubic force constants are used to compute the vibration-rotation interaction constants and hence to calculate equilibrium values of the upper state rotational constants. The cubic and quartic force constants together enter into expressions for the anharmonic vibrational wavefunctions. Wavefunctions of this type are used to calculate relative intensities in the electronic band system. TAB

N69-21577# Aeronutronic, Newport Beach, Calif.

EXPERIMENTAL INVESTIGATION OF THE INFRARED ABSORPTION BY ATMOSPHERIC GASES Final Report

Darrell E. Burch and David A. Gryvnak 31 Jan. 1969 19 p refs

(Contract Nonr-3560(00); ARPA Order 237)

(AD-681713; U-4569) Avail: CFSTI CSCL 7/4

The report summarizes work devoted to the emission of hot H2O and CO2 and to the absorption by these same gas species and other atmospheric constituents. The emission work involved a furnace and gas-handling system which could heat samples to approximately 2000K with the sample at nearly-uniform temperature and pressure. Many of the data have been presented in great detail in scientific reports in the form of tables of transmittance and integrated absorptance versus wavenumber. Strength of many absorption bands have been determined, and widths of the lines have been investigated. More than 25 weak bands of CO2 which had not been reported previously have been observed and identified. New information on the shapes of the extreme wings of CO2 and H2O absorption lines has been obtained. The shapes have unpredicted dependence on the broadening gas and temperature. Author (TAB)

N69-21594# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.

SURFACE TENSION TECHNIQUES FOR MOLTEN SALTS

G. J. Janz, J. Wong, and G. R. Lakshminarayanan Nov. 1968 23 p refs

(Contract Nonr-591(10))

(AD-682216; TR-34) Avail: CFSTI CSCL 7/4

Some 200 surface tension determinations were made on 107 single-salt melts using eight experimental techniques. From a consideration of the experimental difficulties, such as the inconvenience of visual observation on the melt, the corrosive nature of the melt, volatilization and condensation of salt vapors on apparatus, the most versatile method recognized to be applicable to these molten systems at elevated temperatures is the method of Maximum Bubble Pressure, by which 75 per cent of the total determinations on the 107 salts were made. Other methods in descending percentages of application are: Wilhelmy Slide Plate, Capillary Rise, Maximum Pull on Cylinder, Pin Method, Pendant Drop, Ring Method and Sessile Bubble. The basic principles, surface tension range of applicability and temperature limitation for these techniques are briefly considered. Author (TAB)

N69-21599# TRW Systems, Redondo Beach, Calif. Chemical Sciences Dept.

RADIATIVE AND RADIATIONLESS PROCESSES IN AROMATIC MOLECULES: PYRENE

William R. Dawson, John L. Kropp, and M. W. Windsor Oct. 1968 20 p refs

(Contract N00014-67-C-0327)

(AD-682245; TRW-07126-6006-R0-00; TR-8) Avail: CFSTI CSCL 7/5

The fluorescence yield, triplet yield, and fluorescence lifetime for pyrene-h10 and pyrene-d10 have been measured as a function of temperature. The phosphorescence yield, and phosphorescence lifetime, have also been determined. However, in pyrene-d10 the

fluorescence yield increases with increasing temperature, indicating that the rate constant for intersystem crossing has a temperature-dependent part. The variation of fluorescence lifetime and triplet yield with temperature for a pyrene-h10 is attributable in toto to a temperature-sensitive internal conversion; in pyrene-d10 both internal conversion and inter-system crossing are temperature-dependent and contribute to the observed variations.
Author (TAB)

N69-21603# National Bureau of Standards, Washington D. C. Systems Research and Development Div.
CONNECTION TABLES FROM WISWESSER CHEMICAL STRUCTURE NOTATIONS: A PARTIAL ALGORITHM
George F. Fraction, Justin C. Walker, and Stephen J. Tauber Sep. 1968 63 p
(NBS-TN-432) Avail: SOD $0.65

An algorithm was developed for transforming certain types of Wiswesser organic structure notations into connection tables. Acyclic and benzene structures are treated, and provision was made for all of the types of contractions used by the Wiswesser notation system. A separate algorithm is presented for treating linearly fused ring aggregates. A syntax was developed to describe those portions of Wiswesser notations which refer to non-benzene ring systems.
Author

N69-21631# TRW Systems, Redondo Beach, Calif. Chemical Sciences Dept.
RADIATIONLESS DEACTIVATION AND ANOMALOUS FLUORESCENCE OF SINGLET 1,12 BENZPERYLENE
William R. Dawson and John L. Kropp Nov. 1968 25 p refs
(Contract N00014-67-C-0327)
(AD-682246; TRW-07126-6007-R0-00; TR-9) Avail: CFSTI CSCL 7/5

Values of the rate constants for processes that deactivate the lowest excited singlet state of 1,12 benzperylene were determined between -196C and 23C from measurements of the quantum yields of triplet formation, fluorescence, and the fluorescence lifetime. The rate constant for intersystem crossing to the triplet state is nearly same at -196C and +23C. The rate constant for direct radiationless deactivation to the lowest singlet is probably zero at -196C but increases to 600000/sec at +23C. This is similar to results obtained for other aromatic hydrocarbons. However, the fluorescence of 1,12 benzperylene is atypical. An increase in the rate constant of fluorescence, k1, from -196C to +23C is observed resulting from an increase in fluorescence with temperature while fluorescence lifetime decreases over the same temperature range. The increase in k1 with increasing temperature is attributed to a temperature dependent emission from the second excited singlet state. Since the second excited singlet state of 1,12 benzperylene lies only 1275 to 1400/cm above the (1)Lb state, there is significant thermal population of the (1)La state of +23C. The observation of a temperature dependent anti stokes fluorescence supports this interpretation. The effect of solvent upon the energy gap between the (1)La and (1)Lb state and the fluorescence properties of 1,12 benzperylene is discussed.
Author (TAB)

N69-21644# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ISOMORPHISM IN BINARY SYSTEMS OF DIVALENT METAL TUNGSTATES
M. I. Tombak, L. N. Demyanets, and Ya. E. Lapskar Mar. 1968 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (USSR), v. 3, no. 6, 1967 p 55-63
(AD-681671; FTD-HT-23-196-68) Avail: CFSTI CSCL 7/4

X-ray phase analysis and a study of the optical characteristics were used to investigate mutual solubility in two-component systems formed by CaWO4 with tungstates of other divalent metals: MgWO4, ZnWO4, SrWO4, PbWO4 and BaWO4. The formation of a continuous series of mixed crystals in the CaWO4-SrWO4 system was established, and an unlimited miscibility in the CaWO4-PbWO4 system was confirmed. It is shown that in the CaWO4-BaWO4 system a limited solubility is observed at low concentrations of one of the components, whereas in the CaWO4-MgWO4 and CaWO4-ZnWO4 systems no solid solutions are formed over the entire concentration range. Excitation and luminescence spectra of these systems were obtained, and it was found that the character of the excitation spectra can be used to evaluate the phase composition of the system: in the presence of two phases, the spectrum consists of two clearly distinguishable bands. However, emission spectra do not constitute an unequivocal characteristic in studies of isomorphous substitution.
Author (TAB)

N69-21666# Library of Congress, Washington, D. C.
RECENT SOVIET RESEARCH ON INORGANIC NITROGEN FLUORIDES
Serge Markov *In its* Foreign Sci. Bull., Vol. 3, No. 3 Mar. 1969 p 45-55 refs (See N69-21662 10-34)
Avail: CFSTI

Current Soviet research in the chemistry of inorganic nitrogen fluorides, a relatively new class of compounds, is reviewed with emphasis on a recently described preparative route, ammonium salt fluorination.
Author

N69-21679# Technische Hochschule Munchen (West Germany).
TEMPERATURE FIELD MEASUREMENTS IN DARK ZONES OF WALL STABILIZED LOW-CURRENT ARCS BY MEANS OF THE SCHLIERIN METHOD, USED ON H SUB 2-ARC TO DETERMINE HEAT CONDUCTIVITY AND ON MAGNETICALLY DEFLECTED AR-ARCS [MESSUNG DER TEMPERATUREELDER IN DEN DUNKLEN BEREICHEN WANDSTABILISIERTER NIEDERSTROMBOEGEN MIT HILEE DES SCHLIERENVERFAHRENS, ANGEWENDT AUF EINEN H SUB 2-BOGEN ZUR BESTIMMUNG DER WAERMELEITFAEHIGKEIT UND AUF MAGNETISCH ABGELENKTE AR-BOEGEN]
Walter Kollmar (Ph.D. Thesis) 1968 69 p refs In GERMAN
Avail: CFSTI

Schlieren photography was used to measure the refraction index of wall stabilized low voltage hydrogen and argon arcs in symmetrical cylindrical tubes. The temperature dependence of the refraction index was then used to determine gas densities. Hydrogen dissociated at temperatures between 2000°K and 5000°K with a marked increase in thermal conductivity; argon arcs were deflected by an external magnetic field and their temperature profiles were determined for various parameters of deflection. Transl. by G.G.

N69-21710# Naval Research Lab., Washington, D. C.
RAMAN SPECTROSCOPY OF POLYMERIC MATERIALS. PART 1: SELECTED COMMERCIAL POLYMERS
Dorothy S. Cain and Albert B. Harvey Dec. 1968 24 p refs
(AD-681718; NRL-6792) Avail: CFSTI CSCL 7/4

The He-Ne laser has greatly reduced the problem of fluorescence, which has in the past almost completely obscured conventionally excited (mercury arc) Raman spectra of all except the simplest and purest polymers. In many instances it is now possible to record Raman spectra of polymers without any prior purification whatsoever. A comparison of the Raman and infrared spectra of twelve selected commercial polymers shows the complementary nature of these two spectroscopic techniques for identification purposes. Vibrations such as C=C stretching (in polybutadiene) and S-S and C-S stretching (in polysulfide rubber) give rise to strong Raman lines but produce weak infrared absorption bands; conversely, the C=O group of polycarbonates and polyesters is a strong infrared absorber which produces a weak Raman line.
Author (TAB)

N69-21756# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
KINETIC STUDIES OF THE OXYGEN-PEROXIDE COUPLE ON PYROLYTIC GRAPHITE
Ikram Morcos and Ernest Yeager Dec. 1968 51 p refs
(Contract N00014-67-C-0389)
(AD-682217; TR-22) Avail: CFSTI CSCL 7/4

The cathodic and anodic properties of the oxygen-peroxide couple have been studied on ordinary pyrolytic graphite, high pressure annealed pyrolytic graphite and single crystal graphite in alkaline solutions using the rotating disc technique. Both the reduction of O2 and oxidation of peroxide are inhibited on the cleavage surface of the oriented graphite relative to the edge surface. This difference in behavior is attributed to the lack of suitable adsorption sites on the cleavage surface for the reacting species and/or intermediates. Author (TAB)

N69-21759# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Chemistry and Chemical Engineering.
AUTOXIDATION OF POLY(ALKYLENE GLYCOLS) IN SOLUTION
Leo Reich (Picatinny Arsenal) and S. S. Stivala 21 Nov. 1968 27 p refs Submitted for publication
(Contract N00014-68-A-0131)
(AD-681858; ONR-TR-4) Avail: CFSTI CSCL 7/3

Data reported for the autoxidation of poly(ethylene glycol) (PEG) and poly(propylene glycol) (PPG) in solution at relatively long reaction times were analyzed. A relatively simple and a more general kinetic scheme with corresponding rate expressions were used. It was found that the more general scheme gave somewhat more satisfactory agreement between calculated and observed values of several reaction variables. Limitations in the applications of both schemes to PEG and PPG autoxidations are mentioned. Author (TAB)

N69-21770# Akron Univ., Ohio. Dept. of Chemistry.
ELECTRONIC TRANSITIONS IN PHENYLBORONIC ACIDS. 1: SUBSTITUENT AND SOLVENT EFFECTS
Brian G. Ramsey 15 Jan. 1969 30 p refs Submitted for publication
(Contract N00014-67-A-0116)
(AD-681721) Avail: CFSTI CSCL 7/4

The singlet La transition of substituted phenyl boronic acids unexpectedly shifts to higher energy with a solvent change from hexane to water or acetonitrile. This is the result of substantial charge transfer character in the singlet La transition. The singlet La transition energies of p-RC6H4B(OH)2 and p-RC6H4CHO exhibit a linear correlation with mass spectroscopic appearance potentials of RCH2(+). The singlet La transition is discussed in terms of simple molecular orbital calculations. Author (TAB)

N69-21786# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF CERTAIN POLYMERS WITH A CONJUGATE-BOND SYSTEM USING EPR AND IR SPECTROSCOPY METHODS
Yu. G. Nedoshivin et al Jul. 1968 8 p refs Transl. into ENGLISH from the book "Radiospektroskopiya Tverdovo Tela" Moscow 1967 p 408-410
(AD-681612; FTD-HT-23-253-68) Avail: CFSTI CSCL 7/4

EPR and IR spectroscopy methods were used to investigate polymers with conjugate carbon bonds and polymers having small conjugation sectors forming complexes with copper. The concentration of spin centers was determined by graphic integration in comparison with the signal of the investigated substance and a reference point. The polymers containing conjugate polyine groups were obtained in two ways: by dehydrochlorinating polyvinylidene chloride by sodium amide or by the reaction of oxidizing polycondensation of polyacetylene. It is concluded that when conjugation in polymer systems is increased there is a symbatic change in concentration of unpaired electrons and the background of absorption of the infrared spectra. The EPR and IR methods have demonstrated the role of copper in formation of the basic state of cumulene structure in polyine (carbine). Complex formation in the studied polymers proceeds both along the bond C=O and the triple bond C-C and is characterized by absorption bands of 1610 and 750/cm in the IR spectra and by the signal of bivalent copper in the EPR spectra. A narrow EPR signal is not characteristic of such complexes. Author (TAB)

N69-21791# Tyco Labs., Inc., Waltham, Mass.
STUDY OF KINETICS OF ALKALI METAL DEPOSITION AND DISSOLUTION IN NONAQUEOUS SOLUTIONS FINAL REPORT, 16 AUG. 1965-15 AUG. 1968
David R. Cogley and James N. Butler
Bedford, Mass. AFCRL Oct. 1968 116 p. refs
(Contract AF 19 (628)-5525)
(AD-681453, AFCRL-68-0560) Avail: CFSTI

Studies are described of the kinetics and mechanism of both lithium amalgam and solid lithium electrodes in aprotic organic solvents of high purity under controlled conditions. Activation overpotentials were obtained separately from ohmic or mass-transfer contributions by a galvanostatic pulse technique. From these measurements the kinetic parameters of the electron transfer reaction in LiCl-dimethyl sulfoxide were obtained. The observed exchange current in LiCl-DMSO of unit activity on a solid lithium electrode is less than the rate obtained on a saturated lithium amalgam in the same electrolyte. Other investigations reported include studies of the thallium amalgam-thallous chloride reference electrode, a review of electrochemistry in the solvent dimethyl sulfoxide, measurements of the thermodynamic activity of lithium in lithium amalgams, thermodynamics and kinetics of the tetraethyl ammonium amalgam electrode, electrodeposition of lithium on various substrate metals, purification and analysis of dimethyl sulfoxide, solubility of various salts in dimethyl sulfoxide, and details of construction for the galvanostatic pulse generator used in the kinetic measurements. Author (TAB)

N69-21815*# Florida State Univ., Tallahassee.
[FUNDAMENTAL RADIOCHEMICAL ACTS INVOLVED IN THE CROSSLINKING OF POLYMERS] Semiannual Status Report
Leo Mandelkern 1 Mar. 1969 4 p ref
(Grant NsG-247-62)
(NASA-CR-100421) Avail: CFSTI CSCL 07E

Summary data are presented on results from morphological studies on crystalline polyethylene. A variety of experimental techniques yielded densities in the range 0.965 to 0.980, depending on the molecular weight and crystallization temperature. For lower molecular weights for the same crystallite size, the density was greater than for the higher molecular weight species. The effect of irradiation crosslinking was studied on certain thermodynamic properties of highly crystalline polyethylene. To prepare highly ordered crystalline systems from very high molecular weight fractions, the properties of crystals formed in dilute solution under a hydrodynamic shear field were studied. B.P.

N69-21820# National Bureau of Standards, Boulder, Colo. Inst. for Materials Research.
REFRACTIVE INDEX OF GASEOUS AND LIQUID HYDROGEN
Dwain E. Diller 15 Mar. 1968 10 p refs
(PB-180893; R-482) Avail: CFSTI CSCL 7D

The refractive index of gaseous and liquid hydrogen has been measured by an interferometric method at temperatures between 15 and 298.15K and at pressures up to 230 atm. The

measurements have been analyzed in terms of the density and temperature dependence of the Lorentz-Lorenz function. The precision and reproducibility of L-L is better than 0.05% in most cases. L-L for gaseous parahydrogen first increases with increasing density to a maximum and then decreases to values below the low-density limit. L-L is also slightly temperature dependent; the low-density limit increases with increasing temperature; the maximum on the L-L isotherms decreases with increasing temperature. (USGRDR)

N69-21835# Avco-Everett Research Lab., Everett, Mass.
THE HIGH TEMPERATURE PYROLYSIS OF SIMPLE ORGANIC MOLECULES AND THE FORMATION OF C SUB 2
A. R. Fairbairn Dec. 1968 37 p refs Submitted for publication
(Contracts AF 04(694)-690; AF 04(694)-983; F04701-68-C-0036; ARPA Order 1092)
(AD-681452; AERL-RR-304; SAMSO-TR-68-399) Avail: CFSTI CSCL 7/4

The high temperature pyrolysis of simple organic molecules, CH4, CCl4, CF4 and C2H2 has been studied in a shock tube. Under conditions where the final equilibrium composition is almost entirely atomic, the C2 molecule is observed to rise to a peak and thereafter decline, apparently at the same rate as the original compound is decomposing. Absolute intensity measurements on the peak C2 yield indicate that as much as 20% of the carbon atoms can form C2. By following the decay of the C2, the overall rates of decomposition of the organic materials have been obtained. The formation of C2 can be explained in terms of the reaction type CX + C yielding C2 + X. Author (TAB)

N69-21838# Technische Hochschule Munchen (West Germany).
LUMINESCENCE STUDY OF ENERGY TRANSFER IN STYRENE COPOLYMERS USING IONIZING RADIATION [LUMINESZENZUNTERSUCHUNGEN ZUR ENERGIEUEBERTRAGUNG IN STYROL-COPOLYMEREN BEI EINWIRKUNG IONISIERENDER STRAHLUNG]
Alfred Rheude (Ph.D. Thesis) 1968 82 p refs In GERMAN
Avail: CFSTI

Energy transfer bands in luminescent spectra of styrene, vinylpyridine, and isobutylene homopolymers as well as in styrene-vinylpyridine and isobutylene-styrene copolymers were studied after the compounds were exposed to beta irradiation. Polyisobutylene and polyvinylpyridine exhibited optimal luminescent band intensities at 410 nm and 440 nm, respectively; irradiated polystyrene showed maximal luminescence at 390 nm. Similar observations on pentane glasses at 77°K and the identity of alkane molecules with polymeric units in polyisobutylenes attributed the excitation mechanism to the interval in the charge separated state of ions and electrons in alkanes. The formation of this interval was only possible through primary ionization. Transl. by G.G.

N69-21841# Technische Hochschule Munchen (West Germany).
CALCULATING THE REACTIVITY PARAMETERS OF PI ELECTRON SYSTEMS IN SEMI-EMPIRICAL SCF APPROXIMATION WITH SPECIAL CONSIDERATION OF POLAR ALTERNATION BETWEEN REACTION PAIRS [ZU BERECHNUNG DER REAKTIVITAETSPARAMETER VON PI-ELEKTRONENSYSTEMEN IN SEMIEMPIRISCHER SCF-NAEHERUNG MIT SPEZIELLER BERUECKSICHTIGUNG POLARER WECHSELWIRKUNGEN ZWISCHEN DEN REAKTIONSPARTNERN]
Werner Kluge (Ph.D. Thesis) 1968 28 p refs In GERMAN
Avail: CFSTI

The dirigistic effect caused by the electrostatic interaction between reaction partners and its influence on the reaction process are examined, including to what extent the reaction indexes must be modified to allow for this effect. It is shown that in case of reactions between strongly polarized or strongly ionized partners, preferred mutual orientations occur which allow only a few possible bond formations. Bonds with centers that according to the relativity indexes have a high affinity for bond formation may thus not be formed if the statistical equipartition is such as to disfavor it. Transl. by K.W.

N69-21842# Technische Hochschule Munchen (West Germany).
AMBIVALENT BEHAVIOR OF THE OXAZOLONE-(5) AND PSUEDOOXAZOLONE-(5) ANIONS AND MECHANISM OF THA DAKIN-WEST REACTION [UNTERSUCHUNGEN ZUM AMBIVALENTEN VERHALTEN DER OXAZOLON (5) UND PSEUDOOXAZOLON (5) ANIONEN SOWIE ZUM MECHANISMUS DER DAKIN-WEST REAKTION]
Gerhard Hoefle (Ph.D. Thesis) 1968 127 p refs In GERMAN
Avail: CFSTI

Pseudooxazolones-(5) and oxazolones-(5) were studied for their anion reactivities with aliphatic or aromatic tertiary bases or with alkaline carbonic acid compounds. Nuclear magnetic resonance spectra of reactions with pyridine or alkyl-piridines showed that compound formations took place at ion pairs that contained anions as well as cations of ambifunctional characteristics. Transl. by G.G.

N69-21875# Royal Swedish Academy of Engineering Sciences, Stockholm.
SURFACE AND BOND-FORMING PROPERTIES OF QUARTZ AND SILICATE MINERALS AND THEIR APPLICATION IN MINERAL PROCESSING TECHNIQUES
Lars Lindstroem (Roy. Inst. of Tech.) 1968 153 p refs Its Acta Polytech. Scand., Chem. including Met. Ser. No. 75
(PB-180628; APS-Ch-75) Avail: CFSTI CSCL 08G

Contents: Crystalline structure and crystal formation; Solubility in water; Effect of comminution on quartz; Study of the binding of water to quartz; Release of energy from the disrupted-lattice layer; Amine salts as collector reagents for silicate minerals; Flotation experiments with quartz and silicates; Determination of the electrokinetic potential of quartz; Ion adsorption on quartz and feldspar; Dissolution of quartz and gangue minerals; and Investigation of autoclaved lime-quartz products. USGRDR

N69-21889# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
MECHANISMS OF GASEOUS DISCHARGE IN THE ORDER OF 10 – 10 SECONDS [MECANISMOS DE DESCARGA EN GASES EN LA REGION DE SUBNANOSEGUNDOS]
J. T. D'Alessio and H. Lanza 1968 22 p refs In SPANISH
(CNEA-225) Avail: CFSTI

The mechanisms of generating sparks in a pressurized gas which conducts electrical and light pulses on the order of subnanoseconds (10^{-10}sec) are analyzed. The experimental results are interpreted by means of a model, in which liquid mercury with surface tension in equilibrium is injected into an electric field near the electrodes, and an intense electrode voltage on the order of 10^9 volts per centimeter develops. With a field of this magnitude, electrons are produced in sufficient number to explain the experimental results. The multiplication factor for the electron avalanche increases greatly. In this model, only with liquid electrodes in gases at high pressure, and at close distances between electrodes, are pulses developed on the order of 10^{-10}sec. Transl. by F.O.S.

N69-21897# Research Inst. of National Defense, Stockholm (Sweden).
THE REACTIVITY OF ALPHA AND BETA POSITRONS IN THIOPHENES. A SEMIQUANTITATIVE STUDY WITH SPECIAL REGARD TO ELECKTROPHILIC AROMATIC SUBSTITUTION, VOLUME 3, NUMBER 1
Boarje Oestman Jan. 1969 23 p refs
(FOA-1-B-1078-31) Avail: CFSTI

According to isotope effect determinations thiophene behaves in electrophilic aromatic substitutions as a true aromatic compound. The small deviation from a normal isotope effect in nitration could be due to specifics of the thiophene nucleus, but will not affect structure–reactivity considerations. The secondary isotope effect on the S_N2 reaction in the side chain indicates from this point of view a mechanism similar to that for the corresponding benzene derivative. The molecular orbital treatment of the parent molecule shows no preference for the benzene-like d model over the ρ_2 model in predicting the ratio of reactivities towards electrophilic substitution of the α and β positions. The two MO models of thiphene also predict different orders of reactivity of the two α positions of 3-substituted (-I-M) thiophene. It is suggested that for such cases the difference is due to a certain flexibility in the d contribution of sulfur. From the linear relationships between the 2,3:2,5 and the 1/2 o:p isomer ratios, is is concluded that the effect on the thiophenic 3-position of a substituent in the 2-position is quantitatively close to the effect on the benzene ortho position for +M substituents. Author

N69-21902# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF FERROCENE DERIVATIVES BY THE METHOD OF NUCLEAR GAMMA RESONANCE
R. A. Stukan, S. P. Gubin, A. N. Nesmeyanov, V. I. Goldanskii, and E. F. Makarov Jul. 1968 17 p refs Transl. into ENGLISH from Teor. i Eksperim. Khim. (Ukrainian SSR), v. 2, no. 6, 1966 p 805–811
(AD-681603; FTD-MT-24-139-68) Avail: CFSTI CSCL 7/4

Spectra of nuclear gamma resonance of 24 derivative ferrocenes were studied. A relatively weak influence of substituents on hyperfine nuclear gamma resonance spectra and an essential distinction between f and R in investigated compounds was revealed. The coupling of parameters of nuclear gamma resonance spectra with the electron structure of the atom of iron and dynamic properties of molecular crystals is discussed. Author (TAB)

N69-21935# California Univ., Berkeley. Lawrence Radiation Lab.
CURRENT DISTRIBUTION ON A ROTATING DISK ELECTRODE
Vinay Marathe (M.S. Thesis) Jun. 1968 46 p refs
(Contract W-7405-ENG-48)
(PB-180844; UCRL-18264) Avail: CFSTI CSCL 09A

The current distribution on a rotating disk electrode, for the deposition of copper, was studied experimentally for comparison with the theoretical predictions reported earlier. Copper electrodes were used with copper sulfate and sulfuric acid as the electrolyte. The experimental results were found to be in good agreement with Newman's numerical results. Author (USGRDR)

N69-21945# Princeton Univ., N. J. Frick Chemical Lab.
A NEW FUNCTION FOR DIPOLE ORIENTATION AND RUBBER ELASTICITY
Zoltan G. Soos and Arthur V. Tobolsky Jan. 1969 15 p refs
(Contract N00014-67-A-0151)
(AD-682208; ONR-TR-RLT-113) Avail: CFSTI CSCL 7/4

A new function for dipole orientation is derived to describe a collection of fixed, randomly oriented molecules with a dipole moment, achievable by an intramolecular motion such as inversion. This model should be applicable to tertiary amines in the glassy state or imbedded in a glassy matrix. The new function, called the Y function, is similar to the Langevin function at low fields. However at very high fields, the Y function predicts an average dipole moment rather than the value obtained from the Langevin function. The Y function has also been applied to obtain a new equation of state for rubber elasticity at high strains, in the same manner that had previously been achieved starting with the Langevin function (freely-rotating model). This new equation of state for rubber elasticity is superior to that based on the Langevin equation in that it predicts a finite rather than an infinite strain energy. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-20702# Naval Research Lab., Washington, D. C.
IMAGE ENHANCEMENT WITH PROLATE SPHEROIDAL WAVE FUNCTIONS Interim Report
Henry A. Brown Nov. 1968 53 p refs
(AD-681374; NRL-6798) Avail: CFSTI CSCL 17/9

If the electric field intensity in the Fraunhofer region of a one-dimensional radiating source can be represented as a finite Fourier transform of the source current, then the source current can be reconstructed exactly by using prolate spheroidal wave functions and a segment of either the far field or the diffraction-limited image for the noise-free case. An example of the image enhancement of this process is given for the case of two equal point sources, which are unresolved in the Rayleigh sense. The point response function of this process shows that the resolution cell extent can be readily reduced to less than 10% of the Rayleigh cell with only 20 degrees of enhancement processing. A method of generating the Legendre polynomial and power series expansions of the prolate spheroidal angle functions of the first kind and order zero was worked out in detail. The Legendre polynomial expansion coefficients for degrees n = 0(1)40 and the power series expansion coefficients for degrees n = 0(1)36 are tabulated for c = 2. Author (TAB)

N69-20781# Naval Research Lab., Washington, D. C.
LIMITATIONS ON AN IMAGE ENHANCEMENT PROCESS Final Report
Henry A. Brown Oct. 1968 24 p refs
(AD-681251; NRL-MR-1934) Avail: CFSTI CSCL 17/9

In theory, the image enhancement or reconstruction process which utilizes prolate spheroidal wave functions can obtain infinite resolution in a noise-free environment. There are several practical factors which limit this resolution to finite values--truncation of the enhancement process to a finite number of terms, approximation to the process input parameter, the far field, and white noise. Also, for lossy antennas, gain and directivity are limited to approximately that of a uniformly illuminated array. Author (TAB)

N69-20833 Stanford Univ., Calif.
SIGNAL EXTRACTION USING REAL-TIME ADAPTATION OF A LINEAR MULTICHANNEL FILTER
Lloyd Joseph Griffiths (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-11299

The research described herein has developed a system for processing the outputs of a passive array of sensing elements. The system consists of an adaptive linear multichannel filter, together with algorithms for iterative adjustment of the filter coefficients (weights). The system is designed to extract one particular signal (called here the "target signal") in the presence of many other signals, which are considered to be interfering noises. It is assumed that some *a priori* information is available regarding the

characteristics of the target signal, but that no such information is available for the noises. A philosophy is present for designing iterative weight-adjustment algorithms for the processor which directly incorporate any available *a priori* information; which obtain the remaining unknown information from the incoming data; and which adaptively arrive at a system that is optimal according to some predetermined performance criterion. Dissert. Abstr.

N69-20890*# Joint Publications Research Service, Washington, D. C.
RADAR ANTENNAS, RADOMES AND FEEDS
G. I. Yermolayev et al 6 Mar. 1969 14 p Transl. into ENGLISH from the book "Osnovy Radiolokatsii i Radiolokatsionnoye Oborudovaniye Letalel'nykh Apparatov" Moscow, Mashgiz., 1967 p 195-207
(JPRS-47591) Avail: CFSTI

A study of the characteristics of aircraft radar antennas and requirements imposed on them is presented. Descriptions, advantages and disadvantages of various types of antennas and radomes in use are given. The restrictions imposed on aircraft radar sets are listed: (1) zero or small aerodynamic drag; (2) high mechanical strength and minimal weight; (3) high electric strength capable of operating at high altitude at low atmospheric pressure; (4) minimal detrimental interference of the antennas mounted on the aircraft; and (5) minimal effect of aircraft structure on antenna electric parameters. It is concluded that, in the majority of cases, all these requirements cannot be satisfied. F.O.S.

N69-20910*# Notre Dame Univ., Ind.
CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Quarterly Progress Report, 16 Nov. 1968-15 Feb. 1969
James L. Massey 4 Mar. 1969 4 p
(Grant NGL-15-004-026)
(NASA-CR-100395) Avail: CFSTI CSCL 09D

The probability distribution performance of a sequential decoder is analyzed by determining code parameters and the parameters of the Fano decoding algorithm, namely the threshold increment and the branch metric values. Tentative optimization of all parameters show that searches along a "correct path" through the decoding tree obtain a geometric construction by superposition of identical triangles. G.G.

N69-20920 State Univ. of New York at Buffalo.
INFORMATION CAPACITY FOR A TROPOSCATTER COMMUNICATION CHANNEL
Theodore Lerner (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-11496

A method is developed for representing a troposcatter channel for a band limited input signal by a set of subchannels, in which each subchannel consists simply of a time varying random multiplier. The input and output signals are each represented by sequences of numbers, each output number being related to one input number by the associated subchannel multiplier. Using this representation, upper and lower bounds are found for the channel capacity of a troposcatter channel with a constraint on input signal bandwidth and power. The upper bound is determined by assuming that the channel multipliers are known exactly at the receiver. The lower bound is determined by considering the class of systems in which a sounding signal is used to estimate the channel parameters. Dissert. Abstr.

N69-20950 Illinois Univ., Urbana.
LATTICE CODING FOR CONTINUOUS CHANNELS
Robert John Tracey (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-12209

A class of explicit codes for time-discrete amplitude-continuous channels is presented. These codes, called lattice codes, can maintain positive transmission rates over such channels while simultaneously reducing the probability of error to zero, providing only that the channel noise variance is finite. A lattice in n-dimensional Euclidean space is the set of all integer linear combinations of some n independent basis vectors. A lattice code for a given time-discrete amplitude-continuous channel is formed from a lattice by taking for code words all those vectors of the lattice which satisfy the channel constraints. Communication over memoryless time-discrete amplitude-continuous channels with either amplitude or average power constraints using lattice codes is considered. An analysis is given for such channels when lattice codes are used together with bounded distance decoding. Dissert. Abstr.

N69-20975*# IIT Federal Labs., Nutley, N. J. Defense Communications Div.
TIME DIVISION MULTIPLE ACCESS (TDMA) SYSTEM, PHASE 2 Final Report
Oct. 1967 118 p ref
(Contract NAS5-10123)
(NASA-CR-100441; TD-C67-118) Avail: CFSTI CSCL 09F

This constitutes the final report on a Time Division Multiple Access (TDMA) experiment which successfully established the feasibility of a technique for synchronizing system users by two experimental synchronization terminals. The experiment uses a time division format which provides for up to ten stations accessing the satellite simultaneously. Two TDMA terminals were designed, constructed and installed so that the two terminals shared the station transmitter and receiver but otherwise functioned independently. The Relay II medium altitude satellite was used for all experiments. Feasibility and performance were demonstrated by conducting experiments to measure timing error, acquisition time and range prediction accuracy. The typical timing error was measured to be 25 nanoseconds, and the timing error was always less than 75 nanoseconds. The acquisition time for a terminal averaged 25 seconds and was always less than one minute. This represents a small fraction of the total duration of a pass. Techniques for automating this procedure should be investigated. Author

N69-20981 Texas A&M Univ., College Station.
THE IMPUT IMPEDANCE OF A CONCENTRIC CURVED DIPOLE ANTENNA ABOVE A SPHERICAL CONDUCTING SURFACE
Edward Thomas Dickerson (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-11453

An analytical expression is determined for the input impedance of a curved concentric dipole antenna located in close proximity to a conducting sphere. A solution to this boundary value problem is facilitated using the spherical vector mode function. The solution is formulated in an infinite series of spherical Bessel functions, spherical Hankel functions, associated Legendre polynomials, and their derivatives. A general current distribution in the antenna is expressed as a Fourier cosine series. Flexibility is provided so that the impedance as a function of the height above the sphere and as a function of frequency can be determined. Two current distribution assumptions were used, the sinusoidal and the linear. Calculations were made for two different cases, and laboratory measurements obtained to verify the numerical results. Dissert. Abstr.

N69-21022*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-55, VOLUME 2 FOR THE PERIOD 1 NOVEMBER TO 31 DECEMBER 1968. THE DEEP SPACE NETWORK

31 Jan. 1969 104 p refs
(Contract NAS7-100)
(NASA-CR-100433; JPL-SPS-37-55-Vol-2) Avail: CFSTI CSCL 17I

The primary objectives of the deep space network are two way communications with unmanned spacecraft traveling at interplanetary distances and to support space exploration projects. The network system simultaneously performs advanced engineering on components and systems, integrates equipment and methods, and provides direct support of each project through that project's tracking and data system. Deep space network functions constitute: (1) tracking; (2) telemetry; (3) command; (4) monitoring; (5) simulation; and (6) operations control. Design and implementation of technical structures, ground facilities, tracking and navigation analyses, and communications elements and equipment are described in detail. G.G.

N69-21024# Environmental Science Services Administration, Boulder, Colo.
JOINTLY OPTIMUM SIGNALS AND RECEIVERS FOR CHANNELS WITH MEMORY
E. A. Quincy Sep. 1968 48 p refs
(ERL-83-ITS-68) Avail: SOD $0.50

The transmitter and receiver are jointly optimized with a minimum average probability of error criterion. The transmitted waveforms are binary and the receiver is nonlinear with zero memory. Errors are due to additive, Gaussian noise, with independent samples, and adjacent symbol interference. The channel impulse response is assumed to be known and time-invariant. The optimum waveforms are given by the eigenfunction corresponding to the maximum eigenvalue of a symmetric integral operator. In addition, the optimum receiver is given for extensive intersymbol interference, and its probability of error is formulated. The results are applied to data representing an experimental, bandpass, telephone channel with quadratic delay. This example shows approximately 5.5-dB performance improvement over a rectangularly pulsed carrier and standard correlation receiver. The system developed tends to minimize the effect of intersymbol interference while transferring maximum energy through the channel. Author

N69-21085 Cornell Univ., Ithaca, N. Y.
A STATE VARIABLE APPROACH TO OPTIMAL MODULATOR DESIGN
Gerard Albert Ford (Ph.D. Thesis) 1968 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-11622

The techniques of optimal control theory are applied to the optimization of the modulator of a vector analog communication system. A state variable representation is used to specify the source and modulator systems and the associated random processes. The source input and additive channel noise are white and Gaussian. At the outset, a general nonlinear source and modulator combination is postulated. To complete the communication system structure, an approximation to the filter which yields at time t the minimum mean square estimate of the information signal at time t based on all past observations is specified as the receiver. The approximation is needed since the optimal filter is infinite dimensional. Pontryagin's minimum principle is then applied to derive a set of conditions which must be satisfied by the modulator parameters which minimize the integral mean square error between the information signal and its estimate. Dissert. Abstr.

N69-21120# Environmental Science Services Administration, Boulder, Colo.
A REVIEW OF SOME IONOSPHERIC STUDIES BASED ON A HIGH-FREQUENCY DOPPLER TECHNIQUE
D. M. Baker, N. Chang, K. Davies, R. F. Donnelly, and J. E. Jones Jul. 1968 153 p refs
(ARPA Order 932; NSF Order AG-27)
(ERL-78-SDL-1) Avail: SOD $0.75

Frequency fluctuations of ionospheric radio echoes on high frequencies are described. The recording program over the past 7 years and the equipment modifications involved are discussed, along with the elementary theory underlying frequency fluctuations. Solar flare effects (called sudden frequency deviations) are used to determine the relaxation time of the ionosphere. The numerical value is found to be of the order of 40 to 60 s corresponding to an effective recombination coefficient of about 1.3 ± 10^{-7} cm^3 s^{-1}. The results of a detailed study of the physics of a few specific flares are presented. These show that the height of electron production in the ionosphere is not a unique function of wavelength. This sets limits on the use of the ionosphere in the determination of the spectra of the enhanced solar radiations, in the wavelength range from about 1 Å to about 1000 Å. Observations of horizontal ionospheric motions and their interpretation in terms of atmospheric waves are presented. Examples of various types of ionospheric motions, including waves generated by nuclear explosions and by an earthquake, are given. Author

N69-21121# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATIONS CONCERNING THE RADIATION BEHAVIOUR OF ELLIPTICAL WAVEGUIDES AND THE POSSIBILITY OF PRODUCING A CIRCULAR POLARISED CIRCULATION FIELD [UNTERSUCHUNG DES STRAHLUNGSVERHALTENS ELLIPTISCHER HOHLLEITER SOWIE DER MOEGLICHKEIT ZUR ERZEUNGUNG EINES ZIRKULAR POLARISIERTEN STRAHLUNGSFELDES]
K. E. Muller May 1968 32 p refs Transl. into ENGLISH from Hochfrequenztech. und Electroakust. (E. Germany), v. 69, no. 4, 1960 p 140–151
(RAE-Lib-Trans-1294) Avail: CFSTI

General treatment is given of the propagation of waves in a waveguide with an elliptical cross section, the modes of which are described by Mathieu functions. Attention is then concentrated on the even and odd fundamental H_{11} modes and the field patterns of these modes are illustrated for different elliptical shape parameters. The radiation pattern field for each of these modes from an open-ended guide is calculated from the vector Kirchhoff integral using a series approximation for the Mathieu functions. These are such that for the odd mode of radiation only slightly off-circular elliptical cross sections can be treated. The method does not include the effects of outside wall currents and reflections from the open end. The calculations therefore only show the usual fair agreement with the measured field. Simultaneous excitation of both odd and even fundamental modes is shown to create a circularly polarized field. Author

N69-21137# Standard Elektrik Lorenz A. G., Stuttgart (West Germany)
STUDIES AND INVESTIGATIONS ON SIGNAL TRANSMISSION, PARTICULARLY WITH RESPECT OT PCM TELEMETRY SYSTEMS [STUDIEN UND UNTERSUCHUNGEN ZUR SIGNALUEBERTRAGUNG, HAUPTSAECHLICH AUF PCM TELEMETRIESYSTEME AUSGERICHTET]
K. Paehlig and R. Aubele Bad Godesberg, West Germany Bundesministerium fuer Wiss. Forsch. Jan. 1969 179 p refs In GERMAN; ENGLISH summary
(BMwF-FB-W-69-07) Avail: CFSTI

For a command decoder in a PCM telemetry system, theoretical investigations were conducted on synchronization accuracy, detection security, and bit synchronization by means of an optimized filter. Furthermore, methods for error correction by redundancy and repetition, the application of error detecting codes and of codes with variable redundancy, as well as PCM transmission with non-binary, in particular orthogonal signals, have been studied. Author

N69-21141# Environmental Science Services Administration, Boulder, Colo.
THE EFFECT OF IRREGULAR TERRAIN AND ATMOSPHERE ON CORRELATION BETWEEN TRANSMISSION LOSS VALUES
Martin J. Miles Jun. 1968 47 p refs
(ERL-84-ITS-69) Avail: SOD $0.30

Results are presented on the measured effect of irregular terrain and the atmosphere on the correlation between basic transmission loss values at frequencies of 20, 50, and 100 MHz. The correlation coefficient is examined theoretically for losses considered to come separately from the two environmental phenomena. Author

N69-21202 Stanford Univ., Calif.
PHASE AND AMPLITUDE MEASUREMENTS OF MICROWAVES PROPAGATED BEYOND THE HORIZON
Donald Clyde Cox (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-11284

This is an experimental study of microwave signals that are propagated beyond the optical horizon of the earth. The porpagation medium involved is the lower atmosphere from the earth's surface to several tens of thousands of feet. A 12-element vertical antenna array and receiving system, which are described in detail, were designed and assembled. Unique features of this instrumentation is applied to transhorizon propagation research are: (1) The measured parameters are the basic amplitude and relative phase along the arriving wavefront sampled at each of the 12 array elements. (2) The data are sampled and recorded at rates much greater than the rates of change of atmospheric processes. (3) Areference signal is used to cancel the effects of relative A reference of the array support structures from the phase data. Dissert. Abstr.

N69-21209 Alabama Univ., University.
EXTENSIONS OF CIRCULAR AND CYLINDRICAL SYNTHESIS TECHNIQUES AND THEIR APPLICATION TO THE LOCATION OF PATTERN-DISTORTING STRUCTURES IN THE VICINITY OF AN ANTENNA
James Edward Dudgeon (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11246

The techniques for synthesis using circular and truncated cylindrical source geometries are examined and extended. Of special merit are (1) a circular array matrix method which uses a pattern integration to transform the system into one having an easily reducible coefficient matrix, (2) a circular array method which determines the source elements by integration of a broadside, constant azimuth pattern, (3) an approximate cylindrical array method, (4) a simplified matrix solution for cylindrical arrays of small radius, (5) a treatment of a continuous distribution on a cylinder using a Woodward type series, and (6) a prolate spheroidal synthesis. The synthesis procedures are postulated to provide a practical means for locating obstacles or structural features in the vicinity of an antenna that noticeably distort the far-field radiation pattern of the antenna. Dissert. Abstr.

N69-21210 California Univ., Los Angeles.
RANDOM PHASE ERRORS IN END-FED LINEAR ARRAYS
Donald Goodnow Dudley, Jr. (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-11864

A statistical analysis is presented covering the effects of non-deterministic phase errors in end-fed traveling wave arrays. The expectation of the antenna power pattern is calculated based on random, independent phase errors within the transmission line sections. An M-member ensemble of arrays is simulated on a computer and it is shown thereby that the principal effect of the phase error is on the sidelobe response. The antenna E-field equation is transformed into a form whose real and imaginary parts are found to be governed by the central limit theorem. The probability density function of the real imaginary parts is calculated and transformed into the density function of the E-field magnitude. This density is integrated to give the distribution function. The results are used to relate the effects of phase error to antenna tolerance. Dissert. Abstr.

N69-21211 Stanford Univ., Calif.
POLARIZATION OF IONOSPHERICALLY PROPAGATED WAVES
Mark Robert Epstein (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-11260

The theory of wave propagation in the ionosphere was used to demonstrate that regular amplitude variations in HF sweep-frequency oblique-ionogram one-hop rays are due to corresponding variations of the received wave polarization with radio frequency. The rate of occurrence of these variations with frequency was found to increase with increasing radio frequency and path length, and with increasingly close alignment of the propagation path with the longitudinal component of the earth's magnetic field. A model for the one-hop ionospheric signal channel was derived whose parameters are the rate of change of polarization rotation with frequency and phase vs frequency characteristic of the path. Using this model, predictions were made of the effects of polarization rotation with frequency, and also of ionospheric dispersion or phase distortion, on the envelope shape of short-pulse signals. A method for skywave communication was proposed which involves polarization modulation and antennas that launch characteristically polarized waves. Dissert. Abstr.

N69-21280 Illinois Univ., Urbana.
ANALYSIS OF SOME CLOSED LOG-PERIODIC STRUCTURES WITH APPLICATIONS TO LOG-PERIODIC ANTENNAS
Paul Gates Ingerson (Ph.D. Thesis) 1968 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-12134

Several types of closed log-periodically scaled transmission line structures are analyzed and their extension to log-periodic antennas is made. In the case where the structure is composed to a transmission line, log-periodically loaded with scaled lossy transmission line stubs, two important cases are considered. The first case is where the structure is completely lossless and the input impedance into the structure is completely reactive. The second case is where the structure dissipates essentially all the incident input energy and, hence, the input impedance is predominantly real. In this case, the correspondence is made between the complex voltages and stub currents along the structure and the dispersion diagram (k–β) of the corresponding periodic structure, regardless of the element spacing or scaling factor. Dissert. Abstr.

N69-21370# Joint Publications Research Service, Washington, D. C.
PARABOLIC ANTENNAS WITH CROSS-POLARIZED FIELDS
V. P. Narbut and N. S. Khmel'nitskaya 14 Feb. 1969 14 p refs Transl. into ENGLISH from Antenny (USSR), no. 3, 1968 p 83–92
(JPRS-47461) Avail: CFSTI

Results of calculating cross-polarization radiation of axisymmetrical parabolic antennas with opposite-phase field distribution in their apertures are presented. Basic characteristics of cross-polarization patterns are determined for the difference channel employed in the majority of monopulse antennas without the need for cumbersome calculations. An examination was made of a

particular case of calculating cross-polarization radiation of an axisymmetrical parabolic antenna with respect to its difference channel (paraboloid excited by a combination of electric and magnetic equal-moment dipoles). The regularity of cross-polarization radiation of paraboloids excited by having various polarization characteristics close to that of actual exciters are examined. Under these conditions, the limiting cases will be magnetic-dipole, electric-dipole, and Huygens-element exciters. Author

N69-21509# Varian Associates, Palo Alto, Calif.
A DEVELOPMENT PROGRAM TO IMPROVE THE BROADBANDING OF HIGH POWER AMPLIFIER KLYSTRONS Quarterly Progress Report, 1 Jul.–30 Sep. 1968
Louis Zitelli Oct. 1968 17 p
(Contract DAAB07-68-C-0080)
(AD-681927; VARIAN-357-4Q; QPR-4) Avail: CFSTI CSCL 9/1

The report discusses the progress of a program to study and develop two improved broadband high power klystron amplifiers: one designed to operate at 16 kW with 150 MHz instantaneous bandwidth and one designed to work at 8 kW with 100 MHz bandwidth. Author (TAB)

N69-21530# New Mexico State Univ., University Park. Physical Science Lab.
S-BAND TELEMETRY ANTENNA STUDIES, CAVITY-MOUNTED ARRAY
Bruce T. Buller and Dennis G. Henry Oct. 68 99 p refs
(Contract AF 19(628)-5923)
(AD-681459; AFCRL-68-0620; PSL-PS00604; SR-4) Avail: CFSTI CSCL 9/6

An experimental cavity-mounted array was investigated to achieve an S-band telemetry design with suitable radiation pattern coverage for research rockets. The cavity-mounted array is a design configuration in which an array is recessed in a cavity-like section. In the study, the geometric parameters of two cavity configurations were investigated. The two configurations are a cylindrical cavity and a conic-wall cavity. For particular combinations of the geometric parameters, suitable radiation coverage was achieved for both configurations. Author (TAB)

N69-21621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL RADAR PULSE SHAPES
A. F. Tarpugov Aug. 1968 19 p refs Transl. into ENGLISH from Tr. Sibirsk. Fiz.-Tekh. Inst. (USSR), no. 47, 1965 p 163–170
(AD-681675; FTD-MT-24-221-68) Avail: CFSTI CSCL 17/9

Forms of radar pulses ensuring minimum error or maximum of information in determining target position are examined. Author (TAB)

N69-21657# Joint Publications Research Service, Washington, D. C.
SOME INQUIRIES INTO RADAR THEORY AND PRACTICE
A. G. Saybel, ed. 20 Mar. 1969 27 p refs Transl. into ENGLISH of the book "Teoriyai Tekhnika Radiolokatsii" Moscow, Mashinostr., 1966 p 36–43, 122–133
(JPRS-47690) Avail: CFSTI

Chapters 3 and 10 from the Russian book, *Teoriya i Tekhnika Radiolokatsii*, edited by A. G. Saybel, Moscow, 1966. Airborne radar scanning of the earth's surface is discussed. The radar not only scans forward during the flight, but also scans to the sides of the aircraft. Then requirements for component stability and reliability of coherent and pulse radar are presented. J.A.M.

N69-21658# Joint Publications Research Service, Washington, D. C.
RADAR SCAN ENERGY OF LIMITED SECTIONS OF THE EARTH'S SURFACE
B. F. Vysotkiy, et al *In its* Some Inquiries into Radar Theory and Practice 20 Mar. 1969 p 1–11 (See N69-21657 10-07)
Avail: CFSTI

Special features of energy calculations for radar installations on aircraft operating by the system of band-by-band scanning of the earth's surface are considered. Cases of scanning ahead and sideways from the direction of flight are considered. The scan band width is maintained constant at various observation distances. Graphs of signal/noise ratio versus sighting angle of sections of the earth's surface are given. Author

N69-21659# Joint Publications Research Service, Washington, D. C.
REQUIREMENTS FOR COMPONENT STABILITY OF COHERENT-PULSE RADARS
P. A. Bakulev *In its* Some Inquiries into Radar Theory and Practice 20 Mar. 1969 p 12–26 refs (See N69-21657 10-07)
Avail: CFSTI

Relations allowing distribution of the stability requirements among various radar components are derived. Mathematical models are used to establish stability standards, especially using differential equations. Author

N69-21681# Joint Publications Research Service, Washington, D. C.
STATISTICAL CHARACTERISTICS OF THE QUADRATURE COMPONENTS OF SIGNALS REFLECTED FROM A RANDOMLY ROUGH SURFACE
S. G. Zubkovich 18 Mar. 1969 28 p Transl. into ENGLISH from Statist. Kharakteristiki Radiosignalov Otrazhnennykh Ot Zemnoy Poverkhn. (USSR), 1968 p 74–103
(JPRS-47664) Avail: CFSTI

The quadrature components of signals reflected from a randomly rough surface were calculated using mean values, dispersions, and correlation functions. Modulated electromangetic oscillations in radiated signals were used to solve problems involving distance measurement and angular positions. Phase harmonic functions were used to determine uniform phase distribution of elementary reflectors. B.G.D.

N69-21715# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CODING IN COMMUNICATIONS ENGINEERING
K. A. Meshkovskii et al Jun. 1968 277 p refs Transl. into ENGLISH of the book "Kodirovanie i Tekhnika Svyazi" Moscow, 1966 p 1–324
(AD-682065; FTD-HT-23-1670-67) Avail: CFSTI CSCL 9/4

Coding theory and technique are discussed, and the selection of codes in designing transmission and processing systems of discrete information is described. Coding problems with the use of nonuniform and uniform codes, as well as the problems of optimum coded signal reception under various noise conditions and in cases when the parameters of the received signal are unknown are also discussed. The methods of statistical or effective coding are examined in connection with the problem of raising the effectiveness of discrete information transmission systems. The problems of noise-proof coding are examined in connection with the use of uniform codes; the problems of optimum coded signal reception are discussed in relation to the problem of increasing the noise immunity of a discrete information transmission system. Author (TAB)

N69-21757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MATHEMATICAL CONTINUOUS LOGIC AND THE REPRESENTATION OF FUNCTIONS

S. A. Ginzburg 21 Jun. 1968 160 p refs Transl. into ENGLISH of the book "Matematicheskaya Nepreryvnaya Logika i Izobrazheniye Funktsiy" Moscow, 1968 p 1–136

(AD-682155; FTD-MT-24-137-68) Avail: CFSTI CSCL 9/2

The fundamentals of continuous logic (logic operating with continuous values) and its application for representation (electrical simulation) of mathematical functions is expanded. Logic methods of synthesis of analog and hybrid (analog-to-digital) function converters of one and several variables are given. A logic method of analysis of electric circuits containing gates is described. TAB

N69-21769# Stanford Univ., Calif. Electronics Labs.

COHERENT OPTICAL PROCESSING OF TEMPORAL FUNCTIONS

S. David Ramsey, Jr. Nov. 1968 110 p refs

(Contract AF 33(615)-3589)

(AD-681832; SU-SEL-68-068; TR-2306-1) Avail: CFSTI CSCL 17/9

Radarlike pulses were detected in the laboratory when the signal-to-noise ratio was as low as -40 dB, using optical matched filters. A matched filter timebandwidth product of 90,000 has been realized and this product can be easily increased by a factor of 10. Coherent-light optical filters usually use holographic techniques that require the positioning of filter transparencies with accuracies of several microns when the input aperture diameter is 35 mm. An optical matched filter using a new principle has been developed. A standard 35 mm film transport will position the transparencies with sufficient accuracy. A signal and noise intensity modulates a TV-type raster, and a transparency made from this raster is positioned below the optical axis of a collimated laser beam and in front of a transforming lens. A second transparency made from a raster modulated with the matched-filter impulse response is placed in the plane of the first transparency but above the optical axis. The resulting image on the back focal plane of the transforming lens is photographed and the film is developed to have a transmittance that is proportional to the magnitude squared of the light amplitude. If this third transparency is placed in front of the transforming lens, the filter output or the convolution of the signal and noise with the matched-filter impulse response will be imaged on the back focal plane where the signal is detected. This technique may be used to realize a large bank of matched filters to detect radar signals and to estimate various radar parameters when the signal-to-noise ratio is much less than unity. Author (TAB)

N69-21782# Ghana Univ., Legon. Dept. of Physics.

EQUATORIAL STUDIES OF THE VHF SIGNAL RADIATED BY INTELSAT II, F-3. 1: IONOSPHERIC SCINTILLATION

Progress Report, 1 Nov. 1967–29 Feb. 1968

John R. Koster Sep. 1968 57 p refs

(Contract F61052-67-C-0027)

(AD-681462; PR-3; AFCRL-69-0006) Avail: CFSTI CSCL 17/2.1

The VHF signal radiated by INTELSAT II, F - 3 was recorded for just over one year at Legon, Ghana. The scintillation index S, a measure of the depth of fading, is determined for each five minute interval, and the results presented. The fading rate was also determined for six months of this time, and the analysis of the results presented. Author (TAB)

N69-21787# Stanford Univ., Calif. Electronics Labs.

SPECTRAL LOCATION OF RAYLEIGH AND 'm' FADING SIGNALS IN WHITE GAUSSIAN NOISE

N. S. Jayant Oct. 1968 53 p refs

(Contract AF 33(615)-3589)

(AD-681831; SU-SEL-68-058; TR-1829-1) Avail: CFSTI CSCL 17/2.1

The problem of locating a fading sinusoidal signal, known to be present in one of several frequency cells, is analytically investigated. The additive noise is assumed to be white gaussian, and the signal fading is largely modeled by the Rayleigh distribution. Generalizations to non-Rayleigh fading are considered in terms of the m distribution developed by Nakagami. Optimum receiver structures are first derived for the case where the number of (uncorrelated) channel observations, k, is fixed. An energy comparator is shown to be optimum for Rayleigh fading (m = 1), and the probability of signal mislocation by this receiver is derived as a function of m. The theory is extended to the case of sequential reception, where k is not predetermined. A situation in which signal transmissions appear in bursts, occupying only a fraction of the receivers observation time, is also investigated. It is shown that this situation is of interest at small values of the signal-to-noise ratio. The design and performance of fixed-sample-size and sequential receivers are discussed in this context. Finally, the case of nonindependent channel observations at the receiver is considered, for Rayleigh fading signals. The performance of the above-mentioned receivers is discussed in terms of an effective signal-to-noise ratio, and an optimum (time-variant) receiver is derived for signals fading with a gaussian autocorrelation. Author (TAB)

N69-21830# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE USE OF EXTERNALLY MOUNTED PREAMPLIFIERS IN ANTENNA ARRAYS FOR THE METER BAND

R. D. Dagkesamanskii et al Jun. 1968 20 p refs Transl. into ENGLISH from Tr. Fiz. Inst., Akad. Nauk USSR (Moscow), v. 39, 1967 p 29–39

(AD-681637; FTD-MT-24-128-68) Avail: CFSTI CSCL 3/2

The purpose of the article is to refine existing calculations of the gain and sensitivity of antennas used for high-resolution radio telescopes by taking into account the influence of the internal noise temperature of the antenna elements and the influence of the number of preamplifiers and their parameters on the sensitivity of the antenna as functions of the real noise and other characteristics of the receiver and of the feeder system. It is demonstrated that the best improvement in the antenna gain is obtained by using as many external preamplifiers as there are antenna elements. The possibility of reducing the number of preamplifiers without noticeable loss of gain and the best connection points for the preamplifiers are then investigated. A method is proposed for determining the minimum number of preamplifiers and their connection points for a prescribed loss of sensitivity. Methods of compensating for differences in feeder characteristics are discussed. The statistical nature of the galactic background encountered in radio telescope operation is described and its effect on the sensitivity of the antenna array at meter wavelengths is analyzed. The results are used to estimate the increased sensitivity of the east-west line of the DKR-1000 radio telescope, ensuing from the use of external preamplifiers. Author (TAB)

N69-21903# Joint Publications Research Service, Washington, D. C.

FLIGHT VEHICLE ANTENNAS AND ELECTRICAL DURABILITY OF ANTENNAS

G. B. Reznikov 14 Mar. 1969 66 p Transl. into ENGLISH from Antenny Letatel'nykh App. (Moscow) p 301–334, 367–401

(JPRS-47643) Avail: CFSTI

The use of slot antennas for aircraft flying in the ultrashortwave range is discussed. The point at which the antennas are to be installed in the hull of the aircraft is considered along with the directional properties and number of antennas to be installed. The various type are identified as slot antennas with rotational polarization, groove antennas, quasi-isotropic arrays of slot radiators, and open-end waveguide antennas. The problems of electrical and thermal breakdowns of the antennas in aircraft and spacecraft flying at high altitudes are discussed. B.G.D.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-20710# Michigan Univ., Ann Arbor.
FLEXIBLE HIGH-SPEED INTERFACE BETWEEN IBM 1800 AND DEC PDP-7 COMPUTERS
R. F. Brender and J. I. Foy, Jr. Nov. 1968 28 p refs
(Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-681371; TR-12) Avail: CFSTI CSCL 9/2

The principal function of the interface is to transfer blocks of data from the memory of either computer to the memory of the other. Once initialized, the interface transfers data via cycle-steal with respect to each of the two computers memories. Either computer can detect the status of the interface at any time during a data transfer, and can halt or modify the operation as desired. When a transfer operation has been completed, the interface can signal either or both computers. Special circuitry permits resolution of conflicts resulting from simultaneous attempts by both computers to use the interface. Provision is also included for direct signalling of either computer by the other, via an interruption. The operation of the interface during data-transfers is completely controlled by registers internal to itself which can be loaded by either computer; and the condition of the data-handling circuits is indicated at all times by these same registers, which can also be read by either computer. This allows the interface to be commanded fully by either computer or by both. The use of addressable registers to control the interface permits considerable and unusual flexibility in its operation. Author (TAB)

N69-20747 Illinois Univ., Urbana.
ANALOGUE COMPUTATION WITH RANDOM PULSE SEQUENCES
Chushin Afuso (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.50/Microfilm $3.00 Order No. 68-12072

A scheme of analog computation is proposed in which the continuous variable is represented by a probability of occurrence of a random pulse. In this scheme, basic algebraic operations (addition, subtraction, multiplication and division) are performed with digital elements. Therefore, the realization of such computing elements is simpler than that of the conventional analog computing elements. Because of the inherent randomness in the information carriers, the accuracy is directly related to the speed, and in fact, the accuracy is increased only by sacrificing the speed. Two types of system are possible depending on the nature of the information carriers: random pulse sequence (RPS) system, and synchronous random pulse sequence (SRPS) system. A practical way of generating the RPS and the SRPS for a given analog voltage and the realization of the basic computing elements are considered. Dissert. Abstr.

N69-20748 Illinois Univ., Urbana.
A GEOMETRIC APPROACH TO CODING THEORY WITH APPLICATION TO INFORMATION RETRIEVAL
David Kuo-Kien Chow (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-12083

Two related classes of codes derived from Euclidean geometries are presented. The code length, number of information symbols, and minimum distance are shown to be related by means of parameters of a code. These codes can be decoded with a variation of the original algorithm proposed by Reed for Reed-Muller codes. A class of codes from projective geometries is derived in terms of the roots of generator polynomials. These codes are shown to contain corresponding non-primitive Reed-Muller codes as subcodes. Threshold decoding of BCH codes and the generality of L-step orthogonalization procedure to cyclic codes are discussed. Investigation on the application of coding theory to information retrieval is presented. Dissert. Abstr.

N69-20782# Michigan Univ., Ann Arbor.
LOCOSS: A MULTIPROGRAMMING MONITOR FOR THE DEC POP-7
D. R. Frantz, R. F. Brender, and J. L. Foy, Jr. Nov. 1968 125 p refs (Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-681368; TR-10) Avail: CFSTI CSCL 9/2

LOCOSS (Logic of Computers Operating System for the PDP-Seven) was developed to provide a suitable run-time environment in which to run applications programs. Multiprogramming capabilities are an essential part of the system and allow a flexible organization. Provision is made for alternate methods of establishing a separate (parallel) line of execution and for invoking a subtask. Events provide a flexible means of intertask communication. A keyboard Command Interpreter provides a number of real-time control services and simple debugging aids. Input-output is buffered, overlapped, and essentially device-independent, allowing users to write programs with references to generalized sources and sinks. I/O devices supported are: teletype, paper tape reader and punch, 201A dataphone, IBM 1800 (the disk file system and running programs), and the 337 display as a character sink. Additional subroutines are available for such user needs as reading and writing octal or decimal numbers, loading a program from the IBM 1800 disk, and setting an interval timer. Author (TAB)

N69-20814# National Physical Lab., Teddington (England). Central Computer Unit.
A COMPARISON OF ALGOL 60 EXECUTION SPEEDS
B. A. Wichmann Jan. 1969 32 p refs
(NPL-CCU-3) Copyright, Avail: CFSTI

In order to make the methods of evaluating existing computers more effective the performances of different computer systems were compared in terms of their ALGOL 60 facilities. The execution times of individual statements were measured in order to see which language features were dealt with efficiently and which ones were processed slowly. The work was limited to non-interpretative schemes on machines with hardware floating-point. The listing of an analysis program is given, together with the machine times for nine different computers. The technique used is not very suitable for compilers which generate exclusively optimised code. ESRO

N69-20819*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
AMTRAN DEVELOPMENT PROGRAM Interim Report
M. E. Dyar and T. J. Buntyn May 1968 34 p
(Contract NAS8-20415)
(NASA-CR-98362; RL-CL-084) Avail: CFSTI CSCL 09B

A description of the functions and use of the AMTRAN software system developed for the IBM 1130 computer is presented. It is a conversational mode, mathematically oriented, computing system consisting of one or more special remote terminals with push button input and immediate graphical output via storage oscilloscopes. The current version uses the console typewriter for input with typewriter and printed outputs. The system contains a generalized dynamic data storage allocation scheme, the capability for array arithmetic, the ability to construct, store, and recall console programs from the disk, and a disk core overlay system. Author

N69-20862# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS IN MATHEMATICAL OPERATION OF COMPUTERS. ISSUE 2. STANDARD ROUTINES FOR M-20 TYPE COMPUTERS. NO. 2. SERVICE PROGRAMS [VOPROSY MATEMATICHESKOI EKSPLUATATSII VYCHISLITELNYKH MASHIN. STANDARTNYE PODPROGRAMMY DLYA MASHIN TIPA M-20 OBSLUZHIVAYUSHCHITE PROGRAMMY].
T. P. Kuznetsova, T. A. Trosman, and V. V. Martynyuk. May 1968 83 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Komis. Po. Ekspluatatsii Vychislitelnykh Mashin. Vopr. Mat. Ekspluatatsii Vychislitelnykh Mashin (USSR), no. 2, 1965 p 3-80
(AD-681394; FTD-HT-23-1621-67) Avail: CFSTI CSCL 9/2

The booklet, published under the supervision of the editorial council on standard subprograms of the Committee for the Operation of Computers, is intended for programmers and systems analysts concerned with the writing of standard auxiliary programs for the type M-20 computer calculators. It gives detailed instructions for preparing information to be fed into the computer, including coding systems. TAB

N69-20926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMP-1 COMPUTER EXPERIMENT
Roger A. Cliff and Stephen Pauli. Mar. 1969 10 p
(NASA-TM-X-63493; X-711-69-91) Avail: CFSTI CSCL 09B

The SDP-3 Computer was designed to serve as the core of the data system of a small unmanned spacecraft. It is a 16-bit serial machine with 4096 words of memory. The computer will be flown as an engineering experiment on IMP-I. In this application it will handle control and data compression for 4 scientific experiments. Interface between the computer and the experiments is accomplished by experiment interface packages which are located within the experiment package. These packages are supplied to the experiment builder by the computer builder. The experiment interface packages are constructed from a line of standard interface modules, which in turn are built of the same IC's used in the SDP-3. An adaptive format consisting of data tagged with identification and word count is used for data transmission. Author

N69-20947 Stanford Univ., Calif.
GENERALIZED POLYNOMIAL PROGRAMMING: EXTENSIONS AND APPLICATIONS
Gary Edmund Blau (Ph.D. Thesis) 1968 214 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-11274

The theory is extended by expliting special structural features of the functions to obtain criteria for identifying an associated program, the quasidual, as a constrained maximization, minimization or saddle-point problem. The optimal solution to the original, or primal, and the quasidual program are so related that solving either program gives the solution to the other. Fenchel's elegant conjugate function theory is applied to the convex primal program to obtain a still different program, the conjugate dual, possessing the same optimum solution. An indirect nonlinear equation-solving algorithm is developed. The formulation of engineering optimal design problems as generalized polynomial programs is discussed. A chemical reactor system optimal design problem is formulated as an equality constrained problem, transformed into an inequality constrained generalized polynomial program, and solved on the computer. Dissert. Abstr.

N69-20988# Library of Congress, Washington, D. C. Aerospace Technology Div.
LEARNING, SELF-LEARNING, AND PATTERN RECOGNITION Surveys of Foreign Scientific and Technical Literature
Leonas Kacinskas 15 Mar. 1968 52 p refs
(ATD-67-64) Avail: Issuing Activity

Soviet articles published predominantly in the period 1960 to 1966 are surveyed, with the theoretical aspects of the studies being emphasized. Methods for solving pattern recognition problems are discussed, including the method of potential functions and the application of iterative methods of the theory of stochastic approximations. Selection of the complete set of characteristic features describing the patterns is treated. Perceptron-type recognition systems and their applications are studied. Set-theoretical and statistical-probabilistic approaches to pattern recognition are discussed. Studies of the applicability of information theory concepts to problem solving, pattern recognition reliability, and statistical utilization of pattern recognition methods are briefly reviewed. P.A.B.

N69-21030 California Univ., Los Angeles.
AN ON-LINE GRAPHICAL SYSTEM FOR DIGITAL DESIGN
Michael Alvern Holly (Ph.D. Thesis) 1968 198 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-11874

An on-line graphic simulation language has been constructed, as part of a program for developing an interactive system to be used for designing complex digital systems. The new language, GOLD, takes simulation at a macroscopic level by means of block diagram description. Incorporated in the language is a graphic interface which allows both console display and on-line input/output. This language has been used to simulate the TORTOS system, which is designed for time-sharing a large computer among a number of on-line users together with batch background operation. Preliminary results of the simulation are briefly discussed and, from the experience gained in the analysis, a tentative set of specifications is drawn up for an on-line graphical design system. Dissert. Abstr.

N69-21119*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
APPLICATION OF A MODIFIED FAST FOURIER TRANSFORM TO CALCULATE HUMAN OPERATOR DESCRIBING FUNCTIONS
Richard S. Shirley Washington Mar. 1969 30 p refs
(NASA-TM-X-1762) Avail: CFSTI CSCL 09B

A modified fast Fourier transform (FFT) is used in a hybrid computer program to permit processing of tracking data during a run to yield the human operator's describing function almost immediately after the data-taking period. The computer processing time is substantially reduced at no cost in accuracy. Author

N69-21128*# Chrysler Corp., New Orleans, La. Space Div.
CHRYSLER IMPROVED NUMERICAL DIFFERENCING ANALYZER FOR 3rd GENERATION COMPUTERS
D. R. Lewis, J. D. Gaski, and L. R. Thompson 20 Oct. 1967 148 p refs
(Contract NAS9-7043)
(NASA-CR-99696; TN-AP-67-287; CINDA-3G) Avail: CFSTI CSCL 09B

The original CINDA computer program has gained wide acceptance and usage through-out the thermodynamic community and in fact became a standardized program at several installations. However, the original program was unsuitable for standard operation on third generation computers. This new version entitled CINDA-3G is coded in FORTRAN-V for the Univac-1108 computer. Minor portions are coded in the Sleuth II assembly language in order to achieve bit manipulation and shifting operations which required and also to allow certain user subroutines to have a variable number of arguments. Problem data decks prepared for the old version require only a few changes in order to run under the new version. Author

N69-21138# Standard Elektrik Lorenz A. G., Stuttgart (West Germany). Zentrallabor.
DEVELOPMENT OF FERRITE-CORE BUFFER MEMORY OF HIGH CAPACITY [ENTWICKLUNG EINES FERRITKERNSPEICHERS HOHER KAPAZITAET]
M. Bohner, M. Florjancic, and G. Wolpert. Bad Godesberg, West Germany. Bundesministerium fuer Wiss. Forsch. Jan. 1969 107 p In GERMAN; ENGLISH summary
(BMwF-FB-W-69-06) Avail: CFSTI

Continuing the work on a ferrite-core buffer memory of 2 million bits capacity, the requirements for the ferrite cores and matrix planes were established in cooperation with the manufacturer of the memory stack. The measurements carried out on sample cores showed satisfactory output voltages. The circuits were constructed to comply with the electrical characteristics of the sample cores. The development of circuits in multi-chip and thin-film technique was initiated. The design technique and methods applied insure high flexibility and reliability. Tests of the laboratory model incorporating conventional components gave satisfactory results even when using the sample matrix cores not conforming to the requirements. Author

N69-21194*# Denver Research Inst., Colo.
METHODOLOGY FOR INDEXING NASA TECH BRIEFS DEVELOPMENT AND IMPLEMENTATION Final Report
William H. Clingman 8 Nov. 1968 41 p
(Contract NSR-06-004-063)
(NASA-CR-100456) Avail: CFSTI CSCL 05B

Based on the evaluation of present Tech Briefs indexing procedures, an improved indexing methodology was developed. The evaluation and subsequent methodology were based on the needs of a user seeking technology relevant to a particular problem that might be quite unrelated to the NASA problem for which the technology was originally developed. The final form of the indexing procedure recommended involves three steps. First, the Tech Brief is classified into one of five types: circuit or equipment, processes, computer programs, design data or design techniques, or materials. Second, the Tech Brief is read for content and key words are determined corresponding to a set of questions in a checklist provided for each classification. Third, the key words are used in combination with the NASA Thesaurus to choose a final set of index terms. S.P.G.

N69-21208 Illinois Univ., Urbana.
INFORMATION TRANSFER IN COMPLEX SYSTEMS, WITH APPLICATIONS TO REGULATION
Roger Charles Conant (Ph.D. Thesis) 1968 211 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-12097

Information theory and its relevance to the study of complex systems is given. It is shown that multivariable information theory is capable of eliminating much detail while preserving information about the interrelations between parts of a system. A procedure is described and exemplified, which is helpful in the decomposition of hierarchical systems. It is shown, that when two variables are related the transmission between them is maximized when their behaviors are isomorphic. This observation leads to an algorithm for the computation of channel capacity for arbitrary finite-state systems of a very general type. The importance of information in regulatory processes is discussed and quantified, and several basic regulatory schemes are discussed in terms of the information involved, showing in an exact way how information transfer and channel capacity limit the ability of any system to act as a successful regulator. Dissert. Abstr.

N69-21231# Road Research Lab., Crowthorne (England).
A DIGITAL COMPUTER PROGRAM TO SIMULATE THE PASSAGE OF A VEHICLE OVER A ROAD SURFACE
W. R. B. Bellini and E. N. Thrower 1968 24 p
(PB-182097; RRL-LR-181) Avail: CFSTI CSCL 13B

Research on the dynamic behaviour of roads under moving vehicles includes an investigation of the additional loading applied to the road by the passage of heavy commercial vehicles over surface irregularities. The note describes computer programs, written for an I.C.T. Atlas' computer, for the study of the dynamic loading produced by the passage of such a vehicle, either over an isolated irregularity, or along a road, the profile of which has been recorded. Author (USGRDR)

N69-21294# California Univ., Los Angeles. Western Management Science Inst.
PROCESSING AND TRANSMITTING INFORMATION, GIVEN A PAY-OFF FUNCTION
Henri Michel Pham-Huu-Tri (Ph.D. Thesis) Dec. 1968 81 p refs *Its* Working Paper No. 143
(Contract Nonr-233(75); Grant NSF G-2041)
(AD-681347) Avail: CFSTI CSCL 5/1

An information system is defined as a chain of information services, encoding (processing)...transmitting...decoding (deciding). Each service is a transformer represented, in general, by a stochastic matrix and a cost function. The inputs of encoding are the pay-off-relevant events. Actions are the output of decoding, actions and events determine the pay-off. The utility of the services to the user is a function of the pay-off and of the different costs. Efficiently choosing an information system is by definition choosing an information system which maximizes the expected utility. Communication engineers restricted themselves to information systems with fixed transmitting (channel) and identically zero cost functions. Moreover, they equated the users utility function with his pay-off function. The present study is also restricted to information systems with fixed transmitting and zero cost functions and users utility functions identical to their pay-off functions. But the approach is more efficient because the problem is treated of choosing encoding and decoding, given a source of events, a pay-off function and a channel, as a whole. Author (TAB)

N69-21295# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (West Germany). Institut fuer Theoretische Gasdynamik.
A CATALOGUE OF AUTOMATIC DATA PROCESSING EQUIPMENT YEAR 1967. PART 2–1: DIGITAL AND HYBRID COMPUTERS [VERZEICHNIS DER DATENVERARBEITUNGSANLAGEN 1967. TEIL 2–1. DIGITALRECHNER UND HYBRIDE RECHENSYSTEME]
A. Kurau Nov. 1968 401 p refs In GERMAN; ENGLISH summary
(DVL-804; DLR-FB-68-72) Avail: CFSTI

This volume lists all digital computers and hybrid systems installed and in use in the Federal Republic of Germany as of 1967. The listings are arranged according to location of the computers, address of the person in charge, digital computers according to type, hybrid systems, and computing centers. K.W.

N69-21296# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (West Germany). Institut fuer Theoretische Gasdynamik.
A CATALOGUE OF AUTOMATIC DATA PROCESSING EQUIPMENT YEAR 1967. PART 2–2: DIGITAL AND HYBRID COMPUTERS [VERZEICHNIS DER DATENVERARBEITUNGSANLAGEN 1967. TEIL 2–2. DIGITALRECHNER UND HYBRIDE RECHENSYSTEME]
A. Kurau Nov. 1968 409 p In GERMAN; ENGLISH summary
(DVL-805; DLR-FB-68-73) Avail: CFSTI

This volume contains configuration data of all digital computers installed and in use in the Federal Republic of Germany as of 1967. For additional information see abstract N69-21295. K.W.

N69-21303# European Atomic Energy Community, Ispra (Italy). Scientific Information Processing Center.
THE NUMERICAL PROPERTIES OF THE QUOTIENT DIFFERENCE ALGORITHM [LES PROPRIETES NUMERIQUES DE l'ALGORITHME QUOTIENT DIFFERENCE]
R.-F. Gloden, ed. 1968 37 p refs In FRENCH; ENGLISH summary
(EUR-4083.f) Avail: CFSTI

Different variants of the algorithm are considered: progressive form with or without shifts, stationary form, and the influence of round-off errors. Author

N69-21425# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROBLEMS OF COMBINED COMPUTER TECHNOLOGY
B. Ya. Kogan 11 Jul. 1968 28 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Avtomat. i Telemekhan. Vychislitelnaya Tekhnika i Upr. (Moscow), 1966 p 5–18
(AD-682212; FTD-MT-24-168-68) Avail: CFSTI CSCL 9/2

Based on a brief review of analog and digital computer properties, it is concluded that each individual type of computer cannot satisfy the requirements for operating in real time scale over a wide dynamic range of variables with an accuracy of not less than four decimal points. The contradiction between computer accuracy and speed of response which takes place within the framework of one type of image representation leads to the problem of producing calculating systems which would combine devices with a different value representation (analog and digital). Author (TAB)

N69-21527*# System Development Corp., Santa Monica, Calif.
HAND-PRINTED INPUT FOR ON-LINE SYSTEMS
M. I. Bernstein and H. L. Howell Washington NASA Mar. 1969 114 p refs
(Contract NAS12-526)
(NASA-CR-1284) Avail: CFSTI CSCL 09B

This document describes a program for recognizing hand-printed information in real time, which provides on-line computer users with a means of inputting two-dimensional information as simply as writing with pen and paper. The program operates under the time-sharing system and uses a RAND Tablet for input and a CRT display for output. Each user of the program builds a unique character dictionary, based on samples of his own input characters. For each user, the program currently recognizes about 100 different characters, which are chosen from a larger alphabet by the individual user. This document describes how the recognition program interfaces with the time-sharing system; what functions the program performs in recognizing hand-drawn input; and how the character dictionary is constructed and tested. Author

N69-21568*# Carson Labs., Inc., Bristol, Conn.
INVESTIGATION OF 10 SUP 10 BIT OPTICAL MEMORY Interim Report
Andras Bardos 16 Oct. 1967 52 p
(Contract NAS12-125)
(NASA-CR-86135) Avail: CFSTI CSCL 09B

To meet the present day need for a computer system capable of processing great quantities of analog input information in parallel and presenting a simple digital output in short time, three main areas of optical data processing are investigated: (1) The parallel and mostly analog optical processing techniques, which utilize the holographic storage method. (2) High capacity, high throughput optical back-up memories to be connected directly to an existing, conventional electronic data processor. (3) Special computing systems, digital and to a high degree parallel, utilizing special purpose electronic, parallel processors. The properties of Bragg holography in alkali halide crystals are also studied to determine their applicability in the development of optical data storage and processing systems. A.L.

N69-21604# Data Dynamics, Inc., Los Angeles, Calif.
APPROACH FOR CHANGE, JOVIAL EVALUATION PROJECT Final Report
William M. O'Brien Bedford, Mass. ESD Dec. 1968 54 p refs
(Contract F19628-68-C-0301)
(AD-681472; ESD-TR-68-455) Avail: CFSTI CSCL 9/2

The Approach for Change document was produced to establish the criteria for evaluating features of the JOVIAL (J3) computer programming language as specified in AFM 100-24. The document contains arguments for retaining, deleting, or modifying JOVIAL features including a methodology for resolving the arguments. Author (TAB)

N69-21617# Boeing Scientific Research Labs., Seattle, Wash. Information Sciences Lab.
MULTILEVEL STORAGE CONTROL IN PROGRAMMING LANGUAGES
Rudolf Bayer Dec. 1968 24 p refs *Its* Inform. Sci. 23
(AD-682120; D1-82-0795) Avail: Issuing Activity CSCL 9/2

A method is developed to describe and to control the data traffic in a variety of storage devices by the structure of the program. The key idea is to abandon the assumption that declaration of a variable causes storage allocation in main store; instead a variable can reside on an arbitrary storage medium as specified by the declaration. The block concept of ALGOL 60 is extended so as to allow control of main and backup stores by stack mechanisms. The method is compared with own variables in ALGOL 60, input output variables described by Rosen, and paging schemes in multiprogramming and timesharing. A timesharing design with storage management based on the proposed scheme is sketched briefly. Author (TAB)

N69-21625# Aerospace Corp., San Bernardino, Calif.
J-3, PL/1 AND a DATA BASE Technical Report, Aug.–Nov. 1968
E. David Callender and N. Wayne Rhodus 7 Feb. 1969 26 p refs
(Contract F04701-68-C-0200)
(AD-682305; TR-0200(S9990)-4; SAMSO-TR-69-25) Avail: CFSTI CSCL 9/2

The report addresses two problems. The first is to provide an evaluation of the relative merits of the programming languages PL/I and JOVIAL, as constituted by the Version 4 and J-3 compilers, with particular emphasis on ADS Command and Control applications. It is concluded that while both languages are quite adequate, PL/I is much the better and a more powerful language than JOVIAL. The second problem is concerned with ADS data management within an IBM OS/360 operating system environment. The proposed J-4 COMPOOL capability is felt to be quite good and general. It is possible, in a straight forward manner, to provide an equivalent capability both in PL/I and an extension of J-3 within OS. Author (TAB)

N69-21627# RAND Corp., Santa Monica, Calif.
ON UPPER BOUNDS FOR UNRESTRICTED ERROR CORRECTING CODES
S. M. Johnson Dec. 1968 46 p refs
(Contract F44620-67-C-0045)
(AD-681448; RM-5718-PR) Avail: CFSTI CSCL 9/4

The report improves the sphere packing method of establishing upper bounds to the capability of transmission-error-correcting codes. Geometric and algebraic information theory methods are used

in the analysis, which applies to codes unrestricted in the sense that they need not have any group-theoretic structure. The problem is to find the maximum number of binary code words of length n such that every pair of words differs from each other in at least d positions; for d = 2e + 1, the code would correct e errors. Previously published bounding methods are shown to be special cases of a unified approach to this problem. The bounds obtained are based on consideration of the distribution of code points in the neighborhood of a fixed point; previously used inequalities are sharpened by the use of the corresponding error-detecting form, summing over only odd or only even values of the code word weights, and also by bounding the average number rather than the maximum number of code points that are closest to a particular non-code point. The new bounds are improvements over previously published results in almost all of the many cases considered.
Author (TAB)

N69-21629# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN AUTOMATIC PROGRAMMING SYSTEM FOR THE M-20 MACHINE
L. P. Babenko, L. I. Dovgopolaya, G. M. Komienko, and E. L. Yushenko May 1968 141 p refs Transl. into ENGLISH of the book "Sistema Avtomaticheskogo Programmirovaniya Dlya Mashiny M-20" Kiev, Naukova Dumka p 1–156
(AD-682110; FTD-MT-24-90-68) Avail: CFSTI CSCL 9/2

The book describes in detail an algorithmic address language which is convenient for describing computational and complex information-logical processes; it also describes a corresponding programming program which was developed in the Institute of Cybernetics of the Academy of Sciences of the Ukrainian SSR for the domestic, serially-produced M-20 machine. The method of using the PP (programming program) is expounded and examples of programming are given. The use of a new system of automatic programming permits increasing the calculation rate in the electronic computer by 10-15 times.
Author (TAB)

N69-21634# White Sands Missile Range, N. Mex. Atmospheric Sciences Office.
A NON-ENTROPY APPROACH TO SOME TOPICS IN CHANNEL THEORY
Walter B. Miller (Ph.D. Thesis—New Mex. State Univ.) Ft. Monmouth, N. J. ECOM Nov. 1968 70 p refs
(AD-681901; ECOM-5223) Avail: CFSTI CSCL 9/4

A channel is defined. Transmission and reception are discussed with respect to this structure. A set function omega is defined for the measurable subsets of the output space whose value at a given subset is related to the ability of a set to distinguish between transmitted signals. Omega is used to define a measure omega, which is used to determine an upper bound for the length of lambda-codes permitted by the channel. Of these notions omega and omega bar have not previously been considered in the literature. Chapter 2 studies the behavior of omega and omega bar under cartesian multiplication. Chapter 3 is concerned with properties of a channel as reflected in the normed linear space of totally finite signed measures on the output. Key results are concerned with certain extensions of the input space leaving prescribed channel parameters invariant, and in determining certain minimal channels.
Author (TAB)

N69-21655# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIGITAL-TO-ANALOG CONVERTER
V. G. Berlin et al 13 Jun. 1968 12 p refs Transl. into ENGLISH from Pribory i Sistemy Upr (USSR), no. 1, 1967 p 32–33
(AD-681733; FTD-MT-24-126-68) Avail: CFSTI CSCL 9/5

A simpler-than-conventional digital-to-analog converter is suggested, which includes two counters 1 and 2 having a scaling factor K. The input number is placed in counter 1 while counter 2 is set in its initial position. Both counters are fed from a pulse generator. Overflow pulses are time-shifted. The ratio of this shift to the period between overflow pulses - a phase shift between two pulse sequences - is independent of the clock frequency and is determined only by the number placed into counter 1. This phase shift is held until the next number is fed to counter 1; hence, the converter also has a memory characteristic. The phase shift can easily be converted into voltage or current.
TAB

N69-21660# Aerospace Corp., San Bernardino, Calif.
TWO COMPUTER PROGRAMS FOR CONTOUR PLOTTING Technical Report, Jun. 1964–Feb. 1968
Bruce R. Kubert 6 Feb. 1969 75 p
(Contract F04701-68-C-0200)
(AD-682307; TR-0200(S9990)-3) Avail: CFSTI CSCL 9/2

The report describes two computer programs for the contour plotting of functions of two variables. Data can be given at the mesh points of either a rectangular or nonrectangular grid. Linear interpolation is used for locating contours relative to the given grid of data points. A procedure for augmenting the grid of given points by means of a nonlinear interpolating formula is included. If this option is used, the contours are generated by linear interpolation on the augmented grid of points.
Author (TAB)

N69-21667# Library of Congress, Washington, D. C.
NEW ELECTRO-OPTICAL DEVICES
Ivan Velinov *In its* Foreign Sci. Bull., Vol. 3, No. 3 Mar. 1969 p 56–64 refs (See N69-21662 10-34)
Avail: CFSTI

A description is given of a new group of multimode electro-optic devices which can be used as high-speed memory elements with large storage capacities in digital computers.
Author

N69-21718# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF COMPUTERS FOR THE AUTOMATION OF PRODUCTION PROCESSES
A. A. Belostotskii et al Apr. 1968 263 p refs Transl. into English of the book "Primenenie Vychislitelnykh Mashin Dlya Avtomatizatsii Proizvodstvennykh Protsessov" Moscow, 1964 p 1–239
(AD-681635; FTD-MT-24-379-67) Avail: CFSTI CSCL 13/8

The book deals with basic problems involved in the use of computers for the control of production processes. Numerous examples taken from Soviet and foreign practice show the role and position of control computers in various technological processes. Scientific and technical problems arising with the utilization of control computers are discussed, and trends of their development are characterized. The main emphasis is placed on the use of control computers in chemistry, power engineering, metallurgy, and transportation.
Author (TAB)

N69-21752# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ANALOG-DIGITAL CONVERTER FOR SIMULTANEOUSLY CODING TWO ANALOG VALUES AND FEEDING THEM TO AN ELECTRONIC DIGITAL COMPUTER (ETSVM)
A. I. Kondalev Jul. 1968 13 p refs Transl. into ENGLISH from Mekhan. i Avtomatiz. Upr. (USSR), no. 1, 1967 p 22–25
(AD-682179; FTD-MT-24-202-68) Avail: CFSTI CSCL 9/2

Analog-to-digital converters serve to obtain data in numerical form with a high degree of accuracy and store them in the shortest interval of time. A converter was developed at the Ukrainian Academy of Sciences for coding one or two analogs and feeding the results to an electronic digital computer in binary form.
Author (TAB)

N69-21754# Michigan Univ., Ann Arbor.
NETWORK MODELS FOR THE CONVERSATIONAL DESIGN OF STOCHASTIC SERVICE SYSTEMS
Victor L. Wallace and Keki B. Irani Nov. 1968 60 p refs
(Contract DA-49-083-OSA-3050; ARPA Order-716)
(AD-682072; TR-13) Avail: CFSTI CSCL 9/2

Numerical analysis of Markovian queueing networks, and graphical communication of problem statements and results, offer a potential for truly conversational use of computers for high-traffic design of large-scale systems. However, one must develop a translator which converts the pictorial language of queueing network diagrams to the data structures required for efficient numerical analysis. This requires the development of new mathematical models for networks, and for the meaning of their components. Such mathematical models are explored, and their role in the development of adequate programming systems is described. These models, algebraic in form, provide a vehicle for the information conveyed directly by the diagram, the information implicit in the symbology of the diagram, the information upon which the actual calculations are performed, and the procedure which transforms the information from the form of the diagram to the form for calculation.
Author (TAB)

N69-21760# California Univ., Los Angeles. Dept. of Engineering.
THE DEVELOPMENT OF A METACOMPILER CONTAINING LIST PROCESSING CAPABILITIES
Robert Irving Gardner, Jr. Dec. 1968 19 p refs
(Contracts AT(11-1)-GEN-10; Nonr-233(52); SD-184)
(AD-681851; Rept-68-65) Avail: CFSTI CSCL 9/2

A special list-processing system has been developed and integrated with a metacompiler. The special list-processing system is based on directed graph structures which can be created and manipulated by a programmer. Each directed graph structure is characterized by a set of nodes linked together by arcs. The combination of a list-processing facility and metacompiler has been found to be a useful laboratory tool for implementing special-purpose, high-level language translators and compilers and for implementing computer program optimizing systems.
Author (TAB)

N69-21763# Temple Univ., Philadelphia, Pa. Dept. of Mathematics.
TWENTY-FIVE YEARS OF PROGRESS IN INFORMATION THEORY
S. Kotz and J. Wolfowitz Aug. 1968 58 p refs
(Grants AF-AFOSR-1411-68; AF-AFOSR-396-63)
(AD-681447) Avail: CFSTI CSCL 9/4

The report reviews progress to date in what is often referred to as probabilistic coding theory. An extensive bibliography is provided.
TAB

N69-21783# Data Dynamics, Inc., Los Angeles, Calif.
JOVIAL APPLICATION QUESTIONNAIRE Final Report
William M. O'Brien Dec. 1968 151 p refs
(Contract F19628-68-C-0301)
(AD-681471; ESD-TR-68-454) Avail: CFSTI CSCL 9/2

The JOVIAL Application Questionnaire was produced to gather information regarding JOVIAL users experience with the language and the environment in which JOVIAL was being used. This information is to be utilized to evaluate JOVIAL (J3 computer programming languages as specified in AFM 100-24. The questionnaire contains: Instruction on how to fill out the questionnaire; general questions about the application being programmed in JOVIAL; the hardware and operating systems being used ; background information; specific questions about each JOVIAL feature with regard to the conformance of the specification of the feature to AFM 100-24 and the extent of utilization of the feature. In addition, the questionnaire contains a detailed description of each JOVIAL feature as specified in AFM 100-24 as a convenient reference to the users of a different JOVIAL language dialect.
Author (TAB)

N69-21796# Naval Supply Systems Command, Washington, D. C. Research and Development Div.
A FIFTEEN-YEAR FORECAST OF INFORMATION PROCESSING TECHNOLOGY Final Report
George B. Bernstein 20 Jan. 1969 172 p refs
(AD-681752) Avail: CFSTI CSCL 5/2

During Round II a group of outstanding experts in information-processing was asked to evaluate the Round I data bank to identify events of importance and interrelationships between the events. This group was made up of more than 45 of the top names from government, industry, and academia. Round II was a direct application of the normative approach. It should be stressed that Round I (last years effort) was an attempt to provide a data base; whereas, Round II was an attempt to refine, extend, and structure the data base to enhance the value of this forecast for planning and system design personnel. After receiving the inputs from the panel of Round II experts, a refined list of potential events was produced. This list was used to develop a menu of alternative potential short-, mid-, and long-range goals; and to identify supporting events which may be desirable or even necessary to make these goals achievable. A relevance display technique was used to document alternative pathways from the current state-of-the-art to where it will be in the future.
Author (TAB)

N69-21804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RAISING RELIABILITY OF MAGNETIC TAPE STORAGE BY PROGRAMMED ORGANIZATION OF INFORMATION RETRIEVAL IN TAPE SECTIONS
G. G. Ovsyannikov Jul. 1968 16 p refs Transl. into ENGLISH from Teifrovaya Vychislitelnaya Tekhn. i Programmirovanie (USSR), no. 1, 1966 p 67–73
(AD-682178; FTD-MT-24-201-68) Avail: CFSTI CSCL 9/2

One of the principle trends in raising magnetic-tape storage reliability is considered, i.e., organizing the operation of magnetic tapes so that when tape sections fail a specially designed program will on readout correct the errors and renew the record in the section, or select a new section from among the reserves and record the corrected information in it. Organizing the restoration of tape sections in connection with correcting codes or another type of redundancy reduces at least to some degree the number of failures in magnetic tape memories in comparison with the use of correcting codes alone. There are no serious difficulties in the way of this method. The main complication is introducing redundancy into the information and constructing the correcting code. The program operates for a relatively short period during failures and corresponds to several repeated accesses to the tape. Algorithms are given for recording on tape and for readout.
Author (TAB)

N69-21858# Mitre Corp., Bedford, Mass.
PROGRAM/CODING SPECIFICATION FOR THE AFICCS REPORT GENERATION (REPGEN) CAPABILITY
Norman B. Sutherland Jan. 1969 159 p
(Contract AF 19(628)-5165)
(AD-681840; MTR-564; ESD-TR-68-134) Avail: CFSTI CSCL 15/7

The Report Generation (REPGEN) capability comprises a set of programs designed to run on an IBM 1410 computer under the Air Force Integrated Command and Control System (AFICCS). The primary purpose of REPGEN is to provide a capability for producing a printed report from a file of input data contained on

punched cards, magnetic tape or on the system disk. This document contains detailed information regarding the structure and operation of the REPGEN programs, including table descriptions, core maps, program-flow-charts and abstracts. Author (TAB)

N69-21887# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING ETSVM (ELECTRONIC DIGITAL COMPUTERS) TO DESIGN ETSVM
I. Ya. Landau Jul. 1968 15 p refs Transl. into ENGLISH from Sb. Tr. Konf. Molodykh Uch. i Spets. po Kibernetike (No. 1) Moscow, 1964 (Moscow), 1967 p 151–157
(AD-682176; FTD-MT-24-194-68) Avail: CFSTI CSCL 9/2

Many of the most labor- and time-consuming stages in the designing of computers (and of various other automatic systems as well) are based on specific rules and hence logically could be programmed and carried out with the aid of computers. These stages normally consist in: (1) drafting of technical task, (2) drafting of block diagrams of the computer and its elements, (3) compilation of flowcharts for elements of the computer, (4) drafting of functional diagrams on the basis of the flowcharts, (5) separation of functional diagrams into structural elements (modules, panels), (6) drafting of wiring diagrams. The possibility of using existing computers to automate the designing of some of these stages is discussed on bearing in mind that the existing computers have relatively low speeds and memory capacities, while the new computers being designed markedly surpass their designers in number of components and operative speed. Author (TAB)

N69-21890# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT OF COMPUTER ACCURACY BY MEANS OF ADJUSTMENT
R. M. Maresh Jul. 1968 18 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Inst. Avtomat. i Telemekh. Tekhn. Kibernetika. Vychislitelanya Tekh. v Upr. (Moscow), 1966 p 436–444
(AD-681645; FTD-MT-24-227-68) Avail: CFSTI CSCL 9/2

Two methods of adjusting computers are reviewed. Adjustment is accomplished by setting adjustment elements in units and assemblies whose primary errors have the strongest influence on the error of the computer. One method is based on providing for the assigned accuracy, the other, on conditions of optimal accuracy (for instance, adjustment based on the method of least squares). In the first method, the quantity of adjusted errors determines the number of positions in which the assigned accuracy can be achieved. The second method makes it possible to provide for a good compensation of the errors and for their required distribution along the entire operational range of the computer. The mathematical apparatus is reduced to the solution of a system of linear algebraic equations for the purpose of determining the value of adjusting corrections. Adjustment according to the described method requires a large volume of computations which can be accomplished only by means of computers. Author (TAB)

N69-21900# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSMISSION AND CHECK OF INFORMATION IN A COMPUTER SYSTEM UTILIZING PUNCHED CARDS
B. E. Marchuk et al Jul. 1968 16 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 11, no. 7, 1967 p 16–19
(AD-682177; FTD-MT-24-196-68) Avail: CFSTI CSCL 9/2

Various features of a computing system planned for the Moscow Railways are discussed in general terms. The system will automatically keep records and provide control of traffic; it requires transmission of information on trains, cargoes, etc., from way stations and terminals to a computing center; about 8.5 million decimal digits per day are expected. At the computing center, each incoming channel feeds information into a card puncher; later, 80-column cards are introduced into a digital computer. Punching patterns are explained, and types of errors and malfunction are discussed. The summation-check and the parity-check methods are explained. Potentialities and requirements of the readout-function check (Ural-4 computer) and the program check are compared. Author (TAB)

N69-21919# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORM AND DIMENSIONS OF MAGNETIC FILM MEMORY ELEMENTS AND CONSTRUCTION OF STORAGE UNITS
G. P. Zharikov et al Aug. 1968 15 p refs Transl. into ENGLISH from Fiziko-Tekhnol. Vopr. Kibernetike (USSR), no. 1, 1966 p 94–105
(AD-681616; FTD-MT-24-240-68) Avail: CFSTI CSCL 9/2

Factors are reviewed which govern the optimum design of planar printed circuit memories. The form of memory discussed is the matrix of deposited rectangular elements, which is recognized as the best configuration for memory applications. Edge dimensions of an element should vary within the limit ratios from 1.5:1 up to 10:1; substrate can be glass as well as silver, copper, aluminum or similar good conductors. Substrate thickness should not be less than 0.5 - 0.8 mm. Theoretically, bit densities of 500 sq cm are feasible, however, practice has shown that the maximum figure is not over 50/sq cm. A 50 x 50 cm section of substrate is about the maximum that can be uniformly covered by condensate at any given time. Several fabrication configurations are illustrated as having good magnetic properties, minimum interconnections, etc. Author (TAB)

N69-21928*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA COMPRESSION SYSTEM
Irwin M. Jacobs, Leonard Kleinrock, Warren A. Lushbaugh, and Willy Tveitan inventors (to NASA) Issued 14 Jan. 1969 (Filed 7 Dec. 1966) 12 p Cl. 340-175.2
(NASA-Case-XNP-09785, US-Patent-3,422,403, US-Patent-Appl-SN-59975) Avail: US Patent Office

Details are given on a system for storing histogram data in a near optimum number of storage elements or bits. A serial type memory is used in which the storage elements or bits are divided into code words arranged in a sequence. Each code word is associated with a different number of events (such as zero events/period) that may be observed during any one of n observation periods. After each observation period, the content is read out bit by bit and the events counted. At the end of n periods, the number represented by each code word represents the number of periods. During each observation a number of events, equal to the number of events-per-period with which the code word is associated, have been counted. The code used for the selection of the code words is such that a minimum number of bits is required for storing the desired data. NASA

N69-21934# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
SYMBOL MANIPULATION LANGUAGES
Paul W. Abrahams Jun. 1968 122 p refs
(Contract AT(30-1)-1480)
(PB-180828; NYO-1480-97) Avail: CFSTI CSCL 09B

The report reviews the various symbol manipulation languages, including LISP, SNOBOL, SLIP, PL/1, and others. USGRDR

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-20727# Laboratoire de Recherches Balistiques et Aérodynamiques, Vernon (France).

FEEDBACK DEVICE TO CONTROL THE ACCELEROMETERS OF A 60g CENTRIFUGE [ASSERVISSEMENT POUR ACCELEROMETRE SUR CENTRIFUGEUSE 60g]

28 Nov. 1968 18 p In FRENCH
(Contract 68/164/DTEN)
(LRBA-NT-5/SEV-SI-410) Avail: CFSTI

A description is given of the feedback circuit used to control the deviations from linearity of Sagem accelerometers as they are submitted to accelerations of up to 60g. Signals from a 4800 Hz oscillator located at the end of the arm of the centrifuge were amplified and fed to the torque motor through a demodulator and a power amplifier working as a current generator. ESRO

N69-20841# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF SURFACE AND CONTACT PHENOMENA IN THE WORK OF SEMICONDUCTOR INSTRUMENTS

V. A. Presnov Jun. 1968 22 p refs Transl. into ENGLISH from Poverkhn. i Kontaktn. Yavleniya v Poluprov., Tomsk (USSR), 1964 p 5–19
(AD-681241; FTD-MT-24-94-68) Avail: CFSTI CSCL 9/1

It is noted that the electrical parameters of crystalline semiconductor diodes and their stability are determined to a significant degree by the condition of the semiconductor surface. Analysis of the results of studies in this area is given. The following basic means of treating the surface of semiconductors were determined to stabilize the parameters of the devices and to protect the surface from the effect of the surrounding medium: (1) passivation of the surface, i.e., creating inorganic compounds on the semiconductor surface; (2) treating the semiconductor surface with organic materials; and (3) coating the semiconductor surface with glasses of special composition. This problem cannot be solved by empirical methods until the mechanism of the formation and variation of surface charge is understood and the complex nature of surface and contact phenomena accompanying adsorption processes is studied. Author (TAB)

N69-20888*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

PARAMETERS AFFECTING FIRING TIME OF SIMULTANEOUSLY TRIGGERED TRIGATRON SPARK GAP SWITCHES

Michael D. Williams Washington Mar. 1969 31 p refs
(NASA-TN-D-5077) Avail: CFSTI CSCL 09E

The investigation was conducted primarily to determine how the variation of each of several spark gap parameters affects the firing-time differences (switch jitter) of simultaneously triggered trigatron spark gap switches. These parameters were switch voltage (15 to 20 kV), peak trigger voltage (14 to 20 kV), and the curvature of the edge of the trigger electrode hole. The firing times were measured by using the light emitted from the switches. The more significant conclusions are (1) By inference, the physical differences in the members of a switch group create firing-time differences like a component of true switch jitter and only higher switch voltages (of the parameters investigated) significantly diminish their magnitude; (2) true switch jitter is more sensitive to changes in switch voltage than to changes in peak trigger voltage; (3) increased peak trigger voltage is not very effective in reducing switch jitter; (4) the curvature of electrode hole edges does not significantly affect switch jitter in the fast mode of switch operation; and (5) the curves of the firing distributions are not Gaussian integrals as previously believed. Author

N69-20933# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

OPTIMUM TOLERANCE ADAPTIVE THRESHOLD ELEMENTS AS LOGIC CIRCUITS AND PATTERN CLASSIFIERS

G. V. Pallottino 1968 81 p refs
(RT/EL(68)13) Avail: CFSTI

Some developments and results are presented about the training and the operation of adaptive threshold elements, to be used as building blocks for the realization of advanced control systems. A special emphasis was given to the practical problems (tolerance) posed by the actual implementation of these devices and the main result is a new training procedure which maximizes the allowable tolerance. The soundness of the procedure was tested through extensive computer simulation programs by using the adaptive elements both as logic circuits and as pattern classifiers in an handwritten character recognition problem. Author

N69-20977*# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

IMPLEMENTATION OF A DIGITAL CONTROL UNIT FOR A SPACE PROBE USING MOSFETS

H. Hauck Paris ESRO Dec. 1967 44 p refs Supported by ESRO in cooperation with NASA and NAS
(NASA-CR-100449; ESRO-TN-40) Avail: CFSTI CSCL 09A

This report describes the use of Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs) in spacecraft electronic sub-systems. The fundamentals of MOSFETs and rules for their application are presented with emphasis on the application rather than on the theory of operation. Several types of logic systems are compared with respect to their power consumption. A simple but typical digital control unit for a small spacecraft is described. For this unit the implementation is shown using a special family of integrated MOSFET logic blocks. Author (ESRO)

N69-20978# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

BURST NOISE IN SILICON PLANAR TRANSISTORS

J.-C. Martin, D. Esteve, and G. Blasquez Presented at the Conf. on Phys. Aspects of Noise in Electron. Devices, Nottingham, England, 11–13 Sep. 1968
(LAAS-525) Avail: CFSTI

A particular aspect of noise termed 'burst noise' has been observed on silicon planar transistors used at low level amplification. Experiments were carried out in order to complete and corroborate the first experimental results. It appears that the phenomenon arises from instabilities in an elementary recombination current and several explanations are proposed. ESRO

N69-21007# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

NOISE (1/f) IN SILICON PLANAR TRANSISTORS

J.-C. Martin, D. Esteve, A. de Cacqueray, and J.-M. Ribeyrol 1968 6 p refs Presented at the Conf. on Phys. Aspects of Noise in Electron. Devices, Nottingham, England, 11–13 Sep. 1968
(LAAS-524) Avail: CFSTI

Experimental studies on 1/f noise in silicon planar transistors were carried out over the frequency range 10^{-3}Hz to 10^{4}Hz. Experiments were also performed with bipolar and tetrode transistors in an attempt to find a correlation with surface properties. A model of noise mechanism is also briefly illustrated. ESRO

N69-21008# Toulouse Univ. (France). Faculté des Sciences.
THE EVOLUTION WITH TIME OF THE CHARACTERISTICS OF FIELD-EFFECT TRANSISTORS WITH INSULATED GATES [ETUDE DES EVOLUTIONS TEMPORELLES DES CARACTERISTIQUES DES TRANSISTORS A EFFET DE CHAMP A GRILLE ISOLEE]
Pierre Rossel (Ph.D. Thesis) 15 Nov. 1968 150 p refs In FRENCH
Avail: CFSTI

The different laws governing the space charges on the surface of semiconducting materials are discussed and equations for field effect transistors with insulated gates are established and their range of validity estimated. Theoretical and experimental analyses of the evolution with time of the characteristics (variation of gate potential) of most transistors are given. (Variations as small as 1 mV were measured). It is shown that the observed instabilities are due to the superposition of two phenomena one linear, the other asymmetric, which were analyzed by varying the electrical parameters and the temperature. As a result, it is now possible to predict the time variations of MOS transistor properties. ESRO

N69-21127*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
THERMIONIC CATHODE EVALUATION STUDY Interim Report, 1 Oct.–31 Dec. 1968
F. T. Hill 19 Mar. 1969 28 p Prepared for JPL
(Contracts NAS7-100; JPL-451810)
(NASA-CR-100447; Pt-2156; IR-6) Avail: CFSTI CSCL 09A

During the sixth interim period of thermionic-cathode evaluation, diodes using pore-dispenser cathodes have completed at least 10942 hours of life burning and are operating satisfactorily at cathode temperatures of 950°C to 1100°C and at current densities of 0.2A/cm^2 to 1.6A/cm^2. Diodes using standard barium-strontium oxide cathodes have completed life burning times varying from 7600 to 9720 hours. The diodes are showing cathode emission slump at current densities above 0.15A/cm^2 and cathode temperatures of 825°C to 850°C under T_3 and operating conditions. Seven lots of diodes (28 total) were constructed and tested for cathode emission with three different nickel cathode alloys with oxide and coated-particle coating according to the specifications under Modification No. 1 of the program. The diodes showed low and slumping thermionic emission levels attributable to cathode coating peeling in the case of the oxide cathode and sintered coating in the case of the coated-particle cathode. Author

N69-21130*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
MODERN MICROELECTRONICS AND ITS PROSPECTS [SOVREMENNAYA MIKROELEKTRONIKA I YEYE PERSPEKTIVY]
A. G. Alekstenkov, B. V. Malin, and I. P. Stepanenko Washington NASA Mar. 1969 24 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiotekhn. (Kiev), v. 11, no. 7, 1968 p 661–678
(Contract NASw-1692)
(NASA-TT-F-12163) Avail: CFSTI CSCL 09A

The characteristics of integrated circuits are discussed from the point of view of their cost, reliability, dimensions, power and speed of response. A great deal of attention is given to the characteristic aspects of integrated circuits as elementary components of the apparatus, as well as the ranges in which they can be used. The near future and more remote perspectives for the development of integrated electronics are evaluated in terms of the increase in amount of integration, as well as the transition to functional components based on new physical principles. Certain basic problems of universities concerning scientific research in the field of microelectronics are formulated in conclusion. Author

N69-21158# Royal Aircraft Establishment, Farnborough (England).
RELIABILITY IMPROVEMENT BY REDUNDANCY IN ELECTRONIC SYSTEMS. PART 1: A METHOD FOR THE ANALYSIS AND ASSESSMENT OF REDUNDANCY SCHEMES
Theresa F. Klaschka May 1968 49 p refs
(RAE-TR-68130-Pt-1) Copyright. Avail: CFSTI

Many schemes for applying redundancy to improve electronic system reliability are known, but their relative merits have not been satisfactorily assessed. By analysing a general model of an ideal redundancy scheme, an apposite measure of the reliability improvement produced by a redundancy scheme is found; and it is shown that the measure is to a close approximation applicable to most real redundancy schemes. The measure overcomes many of the problems previously encountered in redundancy scheme assessment since it is independent of the size of system to which the redundancy scheme is applied, it has a good sensitivity characteristic, and it is relatively easy to evaluate by considering the possible failure modes in a small representative part of the system. The reliability improvement measure, together with an appropriate redundancy 'cost' factor, is shown to express the performance of a redundancy scheme adequately and concisely, and some preliminary results of such a comparative assessment of a selection of redundancy schemes are presented. Author (ESRO)

N69-21313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONMAGNETIC THERMAL MOTOR FOR A MAGNETOMETER
William J. Kerwin and Stanley G. Scott, inventors (to NASA) Issued 21 Jan. 1969 (Filed 2 Aug. 1965) 6 p Cl. 310-4
(NASA-Case-XAR-03786; US-Patent-3,423,608; US-Patent-Appl-SN-476763) Avail: US Patent Office

A nonmagnetic thermal motor for moving a magnetometer from one predetermined calibration position to another is described. Two spiral bimetallic elements are series-connected between a casing and a rotatable shaft. An electric heater is situated within each bimetallic element. A frame fastened to the casing rotatably supports an output shaft. A crank arm is attached to each of the shafts and the arms are interconnected by a spring. The arms and spring cause a magnetometer coupled to the output shaft to assume a first or second position. The positions are alternated by selectively energizing the bimetallic elements.
Official Gazette of the U.S. Patent Office

N69-21354# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Munich (West Germany).
ON THE TRIGGERED GENERATION OF SEVERAL SIMULTANEOUS SPARKS [UEBER DIE GESTEUERTE ERZEUGUNG VON MEHREREN GLEICHZEITIGEN ZUENDFUNKEN]
G. Zhuber-Okrog and G. Requardt Dec. 1968 29 p refs In GERMAN; ENGLISH summary
(DLR-Mitt.-68-32) Avail: CFSTI

Considering the possibilities of several simultaneously generated high voltage sparks it appears that transformed condenser discharge has considerable advantages. Such an ignition system was built. A hydrogen thyratron which is triggered by impulses discharges a condenser through the primary windings of 14 ignition coils. The primary windings are connected in series. The operation of this system is illustrated by oscillographs. Further applications are discussed. Author

N69-21424# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Dept. of Electrophysics.
WIDE ANGLE INTERNAL DEFLECTION STRUCTURES OF CATHODE-RAY TUBES Final Report, 1 Apr.–30 Jun. 1968
Rudolf G. F. Hutter Oct. 1968 25 p refs
(Contract DA-28-043-AMC-02449(E))
(AD-681869; ECOM-02449-F; Rept-6) Avail: CFSTI CSCL 9/1

The report provides a summary of the accomplishments of a program for the development of improved cathode ray tubes. TAB

N69-21467*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
PLURAL RECORDER SYSTEM
James E. Kessel, inventor (to NASA) Issued 14 Jan. 1969 (Filed 27 Apr. 1967) 6 p Cl. 346-44
(NASA-Case-XMS-06949; US-Patent-3,422,440; US-Patent-Appl-SN-635328) Avail: US Patent Office

A comparison amplifier is used to compare a reference generator with a plurality of test units whose outputs are monitored and compared with the reference generator signals. All the signals are fed to a comparison amplifier and when one of the signals is different, an output signal will be produced which is used to actuate a strip chart recorder. The signals are also fed to a continuous loop tape recorder. From the continuous loop tape recorder the signals are reproduced on the strip chart recorder when it is actuated. Thus, only when a variation between one of the input signals occurs does the strip chart recorder record the signals. Provision is also made to record the signals prior to the time error occurs and after the error was removed. Official Gazette of the U.S. Patent Office

N69-21468*# General Dynamics/Convair, San Diego, Calif.
SIGNAL GENERATOR
Leonard A. Del Casale and Bernhard Blutinger, inventors (to NASA) Issued 14 Jan. 1969 (Filed 29 Jun. 1966) 6 p Cl. 307-106
(NASA-Case-XND-05612; US-Patent-3,422,278; US-Patent-Appl-SN-562934) Avail: US Patent Office

This invention relates to an alternating current signal generator that provides a plurality of amplitude modulated output signals that are useful for testing various electronic systems. The ramp function generator is mechanically connected to A. C. motor and provides a constant frequency A. C. output signal, which is amplitude modulated in accordance with a ramp or triangular frequency function. Sweep function generator is similarly driven by the A. C. motor and provides a feedback signal via line to motor that causes the resolver to rotate at varying rates of speed to provide a constant frequency output signal, which is amplitude modulated through a range of modulation frequencies. The time that is required to sweep through the range can be varied by adjustment of the sweep function generator. NASA

N69-21470*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONNECTOR: ELECTRICAL
James W. Mayo and James E. Michael, inventors (to NASA) Issued 7 Jan. 1969 (Filed 2 Jun. 1965) 4 p Cl. 339-150
(NASA-Case-XLA-01288; US-Patent-3,421,134; US-Patent-Appl-SN-460876) Avail: US Patent Office

This invention relates to an electrical adaptor for distributing current to several electrical circuits from a lesser number of electrical circuits. It comprises a cylindrical housing having external threads on one end and internal threads on the other. A plurality of distributor plates having a single contact protruding from one side and a plurality of contacts protruding from the other are positioned between insulators mounted within the casing. Official Gazette of the U.S. Patent Office

N69-21516# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
DEVELOPMENT OF TRANSMITTER TUBE FOR TROPOSCATTER APPLICATIONS Final Report, 1 Jul. 1966–31 Dec. 1968
Thomas B. Brown, Otto G. Sauseng, Gordon A. Lange, J. C. Dixon, and Arthur L. Rousseau Jan. 1969 98 p refs
(Contract DA-28-043-AMC-02316(E))
(AD-682004; W-2275-3; ECOM-02316-F) Avail: CFSTI CSCL 9/1

The program objective was to determine the design criteria for a highly efficient (50% overall efficiency including focusing and cooling power) 10 kW CW traveling-wave amplifier at C-band designated the 636H and to demonstrate a feasibility model of the device. This amplifier is to have 11 dB of gain to boost the output of existing 1 kW Troposcatter systems using power generators readily available. Techniques to improve the efficiency by reducing the power necessary to cool the device were an integral part of the program. The tube employed a coupled cavity interaction circuit with a solenoid focused, semi-confined flow electron beam. Improvement in basic tube efficiency was accomplished by voltage jump tapering combined with collector depression. Cooling efficiency was improved by utilizing vapor phase (nucleate boiling) cooling, eliminating the need for a coolant pump. Author (TAB)

N69-21531# Stanford Univ., Calif. Electronics Labs.
MICROWAVE AMPLITUDE LIMITERS FOR WIDEBAND LOW-DISTORTION APPLICATIONS Technical Report, Jan. 1966–Jun. 1967
Robert R. Falconer Oct. 1968 119 p refs
(Contract AF 33(615)-3589)
(AD-681825; AFAL-TR-68-203; SU-SEL-68-012 Avail: CFSTI CSCL 9/5

The study presents the results of an investigation of microwave amplitude limiters. The purpose of the study was to seek out and compare the characteristics of microwave devices used as limiters, and to determine which of those considered are capable of low-phase-distortion, broadband, wide-dynamic-range envelope limiting. A resume of performance characteristics is given for several types of microwave limiters. Theoretical analyses are presented for a single-ended mixer-limiter and for five component arrangements of balanced mixer-limiters. Results of laboratory measurements are given, principally for the microwave mixer-limiter and tunnel-diode amplifier-limiter. Measurement data include static and dynamic limiting characteristics, frequency and time-domain photographs, and static and dynamic phase-distortion measurements. A novel technique was used to measure nonlinear phase distortion (AM-to-PM conversion) using input amplitude variations at rates of the order of tens of megahertz. Author (TAB)

N69-21534# General Electric Co., Owensboro, Ky. Tube Dept.
C-BAND AND X-BAND DUAL FUNCTION OSCILLATORS Quarterly Report, 1 Dec. 1967–29 Feb. 1968
J. D. Marshall and J. B. Quirk Ft. Monmouth, N. J. ECOM Nov. 1968 34 p
(Contract DA-28-043-AMC-02340(E))
(AD-681895; ECOM-02340-7; QR-7) Avail: CFSTI CSCL 9/5

Considerable effort was devoted to determining the cathode processing and improvement which will be effective in achieving greater stability during life at C-band. C-band circuit development work was devoted to optimization for each tube in each of the seven lots of tubes that were evaluated. Effort directed toward the development of X-band triodes and circuits was minimal while the cathode study was being made. The construction features for the seven lots of tubes used for cathode evaluations are provided. Data has been included to indicate the relationships between triode characteristics and oscillator performance. Life testing of

representative tubes from five lots was initiated using a video grid-pulse condition. Although these tests are incomplete, preliminary results are included. C-band triode-cavity oscillators were assembled and tested preparatory to shipment of five units to the contractors test facility. Oscillator life tests will be conducted on the remaining units. Triodes in these circuits have incorporated the interwoven damper-wire grid structure. Frequency modulating effects as a function of changes in pulse repetition rate are included as part of the triode-cavity oscillator performance data. Author (TAB)

N69-21535# General Electric Co., Owensboro, Ky. Tube Dept.
C-BAND AND X-BAND DUAL-FUNCTION OSCILLATORS Quarterly Report, 1 Jan.–29 Aug. 1968
J. D. Marshall and J. B. Quirk Ft. Monmouth, N. J. ECOM Dec. 1968 29 p
(Contract DA-28-043-AMC-02340(E))
(AD-681897; ECOM-02340-9; QR-9) Avail: CFSTI CSCL 9/5

Evaluation of Y-1662-A and Y-1662-D triodes is described. C-band oscillator life test results are presented. Video grid pulse life test results are also provided. The test circuit used to evaluate triode performance is described. Triode development has continued with the effort directed toward improving the effect of the interwoven damper wire grid structure in reducing wire motion. Author (TAB)

N69-21536# General Electric Co., Owensboro, Ky. Tube Dept.
C-BAND AND X-BAND DUAL FUNCTION OSCILLATORS Quarterly Report, 1 Mar.–31 May 1968
J. M. Connelly and J. B. Quirk Dec. 1968 22 p
(Contract DA-28-043-AMC-02340(E))
(AD-681896; ECOM-02340-8; QR-8) Avail: CFSTI CSCL 9/5

The purpose of the program is to develop two oscillators, one at C-band and one at X-band which function sequentially as a transmitter and as a gated local oscillator in their respective bands. These oscillators should have the potential of low cost, design simplicity, and low power drain to meet the requirements of lightweight radar sets having a common transmitter and local oscillator stage. Author (TAB)

N69-21542*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRODE AND INSULATOR WITH SHIELDED DIELECTRIC JUNCTION
R. C. Finke, inventor (to NASA) Issued 7 Jan. 1969 (Filed 21 Mar. 1967) 5 p Cl. 174–18
(NASA-Case-XLE-03778; US-Patent-3,420,945; US-Patent-Appl-SN-628247) Avail: US Patent Office

A hollow spherical electrode forms a shield about the negative junction of an insulator in high vacuum to increase vacuum voltage standoff capabilities. Official Gazette of the U.S. Patent Office

N69-21543*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC ACQUISITION SYSTEM FOR PHASE-LOCK LOOP
Ralph E. Taylor, inventor (to NASA) Issued 7 Jan. 1969 (Filed 28 Feb. 1967) 11 p Cl. 331–4
(NASA-Case-XGS-04994; US-Patent-3,421,105; US-Appl-Patent-SN-619907) Avail: US Patent Office

Disclosed is a system for phase locking onto an unknown carrier frequency signal located within a receiver band pass. A variable frequency source is heterodyned, to derive a beat frequency, where in the output of a local oscillator is swept at a relatively rapid rate while the system is in an acquisition mode. The beat frequency is applied to a first filter having a response time to enable the beat frequency to dwell therein for a relatively long time period. With the local oscillator scanning rate reduced, the beat is applied as a frequency control to the local oscillator and a phase locked tracking loop for the input is thereby formed. The beat frequency is applied to a second filter having a longer response time than the first filter. Only in response to the second filter output being above a selected value within a predetermined time interval after the first filter output is above the predetermined level, is the phase locked loop maintained.
Official Gazette of the U.S. Patent Office

N69-21562# Illinois Univ., Urbana. Coordinated Science Lab.
A STUDY OF ELECTROLUMINESCENT CADMIUM SULFIDE DIODES
Jerry Albert Kastning Dec. 1968 66 p refs
(Contracts DAAB07-67-C-0199; DAAK02-67-C-0546)
(AD-681705; R-400) Avail: CFSTI CSCL 9/1

The purpose of this thesis is to present an experimental description of a number of tellurium-cadmium sulfide heterojunction devices and a theory to explain their mechanism of operation. These devices exhibit electroluminescence when operated at liquid nitrogen temperatures. Liquid emission from a p-n junction was first observed by Lossev, in 1923, in naturally occurring junctions. Since the efficiency for conversion of electric energy into light was very low, these junctions did not seem to be of much importance until the discovery of the p-n junction laser in 1963. Therefore, within the past several years, there has been considerable interest in the phenomenon of p-n junction luminescence which has resulted in numerous investigation of the properties and potential applications of semiconductor-diode light sources. From an application point of view, the fact that luminescent emission is such a basic way of efficiently communicating information to the eye makes it a tool whose utility extends to practically every area of technology. Author (TAB)

N69-21570*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
ANALYTICAL STUDY AND EXPERIMENTAL INVESTIGATION OF TECHNIQUES FOR IMPROVING ELECTRON TUBES FOR SPACE APPLICATION
E. C. Conway and M. J. Kelley Dec. 1968 232 refs
(Contract NAS12-565)
(NASA-CR-86137) Avail: CFSTI CSCL 09A

An analytical and experimental study was conducted to determine means of improving electron tubes for space applications. The work was directed toward two specific areas: elimination of electrical heaters and cooling of high power dissipation elements. To eliminate the electric cathode heaters, a triode was designed and constructed with heat pipe integrated into its cathode structure to allow the use of an external heater. Curium-244 was found to be better suited to cathode heating, and being small enough to be inserted into the cathode support permitted elimination of a heat pipe. Investigation of high power tubes showed that most tubes are not suited to heat pipe cooling, since passages designed for liquid cooling are inadequate for use as evaporators. Application of the heat pipe to cool the dissipating elements of a high power electron tube provides a system capable of highly reliable operation over very long periods of time. Since many high power tubes do not have suitable interfaces for cooling by heat pipes, designs for both tube and heat pipe evaporator must be integrated. A.L.

N69-21571*# Syracuse Univ. Research Corp., N. Y. Special Projects Lab.
ELECTRON MULTIPLIER DEVELOPMENT (PHASE 1)
Wan Sang Chung and Chih-shun Lu Jan. 1969 30 p refs
(Contract NSR-33-144-003)
(NASA-CR-100494; SPL-TR-69-3) Avail: CFSTI CSCL 09A

The feasibility of fabricating a thin film window to permit the transmission of primary electrons of energy range 5–15 Kev but strong enough to sustain a pressure difference of one atmosphere was examined. The correlations between the electron transmission

coefficient and the mechanical strength of thin films were studied both theoretically and experimentally. It was found that a composite film of aluminum and aluminum oxide with a total thickness of about 2000 Å and supported by a 75-mesh grid could meet the requirements. Techniques for preparing such a window are presented. Experimental results obtained from several films were satisfactory although further optimization and improvements are needed. Recommendations are made for further developmental effort directed toward the final realization of a practical sealed-off capillary-type electron multiplier. Author

N69-21602# National Bureau of Standards, Washington, D. C. Electronic Instrumentation Div.
A BIBLIOGRAPHY ON METHODS FOR THE MEASUREMENT OF INHOMOGENEITIES IN SEMICONDUCTORS (1953–1967)
Harry A. Schafft and Susan Gayle Needham May 1968 48 p refs
(NBS-TN-445) Avail: SOD $0.35

About 130 papers which deal with the measurement techniques useful in detecting the type and location of various inhomogeneities, primarily in germanium and silicon, are listed with key words. The types of inhomogeneities considered are those in impurity concentration, resistivity, mobility, diffusion length, lifetime, surface conditions, crystal perfection, and p–n junctions. Some of the 22 effects or methods used to detect these inhomogeneities are: photovoltaic, electron-voltaic, photoconductivity, one-, two- and four-point probe, spreading resistance, and voltage breakdown. There are three indexes: a reference tabulation according to key words, a reference tabulation according to methods or effects used to detect an inhomogeneity, and an author index. Author

N69-21638# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
THREE THOUSAND TWO HUNDRED ANGSTROM PHOSPHOR Quarterly Report, 1 Jul.–30 Sep. 1968
Jon W. Ogland, Edward C. Malarkey, and Michael R. Natale Ft. Monmouth, N. J. ECOM Dec. 1968 27 p refs
(Contract DAAB07-68-C-0392)
(AD-681934; ECOM-0392-1; QR-1) Avail: CFSTI CSCL 9/1

The report discusses a research and development program leading to the production of a cathodoluminescent phosphor which emits with high efficiency in the spectral region around 3200A. This phosphor is to be incorporated into very high resolution cathode-ray tubes with fiber optic faceplates for data recording on UV sensitive, dry-processed film. The materials to be investigated in this program and the reasons for their selection are summarized. Descriptions are given of the experimental equipment and procedures. The results of experimental investigations of beta-CaSiO3, alpha-CaSiO3 and beta-Ca2SiO4 lead-doped phosphors are presented. The first of these had been previously shown to be an efficient UV phosphor with an emission peak at 3400A; the test samples prepared during this quarter exhibited comparable efficiencies and work is progressing to optimize the doping concentration. The beta-Ca2SiO4:Pb samples exhibited very intense luminescence in a broad band centered at 3800A. While the emission band is not where it was expected to be, and is a poor match to the specifications, the phosphor may be useful in other applications. Author (TAB)

N69-21640# Air Force Cambridge Research Labs., Bedford, Mass.
SOLID STATE dc ELECTROMETER AMPLIFIER Instrumentation Papers No. 154
Robert S. Cukay Dec. 1968 16 p refs
(AD-681660; AFCRL-68-0663) Avail: CFSTI CSCL 9/5

The paper describes a solid state A-C electrometer amplifier which has a dynamic input current range of four decades (10 to the minus 11 to 10 to the minus 7 amperes at 2.5 KHz) while maintaining a high degree of temperature stability, plus or minus 5 percent of full scale voltage over an ambient temperature range of -20 degrees to +60 degrees C. Circuit design considerations which include Field Effect Transistors (FET) amplifier-noise-parameter criteria, linearity, temperature stability, and frequency response are discussed. In addition, graphs indicating amplifier dynamic range, frequency response, and rise time are included. Author (TAB)

N69-21656# Naval Avionics Facility, Indianapolis, Ind.
SOLDERLESS WRAPPED ELECTRICAL CONNECTION TECHNIQUES Final Report
Howard A. Johnson 1 Oct. 1968 236 p refs
(AD-681732; NAFI-TR-1228) Avail: CFSTI CSCL 9/5

The report provides a list of published reports of the process and techniques of solderless wrapped electrical connections commonly known as wire wrap. These reports and publications encompass subjects such as evaluation, testing, development, specifications, tooling, quality assurance, process control, and inspection procedures. Author (TAB)

N69-21687# Army Electronics Command, Fort Monmouth, N. J.
SYNTHESIS OF DISTRIBUTED WIDE-BAND TRANSISTOR AMPLIFIERS BY COMPUTER TECHNIQUES FOR APPLICATION TO MICROWAVE INTEGRATED CIRCUITS
I. L. Chase and V. G. Gelnovatch Dec. 1968 46 p refs
(AD-681902; ECOM-3067) Avail: CFSTI CSCL 9/5

The problem of wide bandwidth and flat in-band gain response for microwave transistor amplifiers has been reduced to the optimization of a number of important variables from computer-prepared design charts. Through the general flexibility of the computer-generated data, a large variety of amplifier responses are possible using distributed circuit matching networks. The work of H. A. Wheeler is presented in order to accomplish the transition for the TEM (transverse electromagnetic) solution obtained for transistor response to the microwave integrated circuit technology (microstrip). As experimental verification of the overall design procedure, single-stage and two-stage octave wide transistor amplifiers were fabricated on 1 inch by 1 inch and 1 inch by 1/2 inch 20-mil-thick alumina, respectively. The experimental data gained from these units showed excellent correlation to the computer-predicted response. Author (TAB)

N69-21693# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL DESIGNING OF A SALIENT-POLE INDUCTOR OF A SYNCHRONOUS MACHINE
A. Avetsyan et al 9 Aug. 1968 18 p refs Transl. into ENGLISH from Elektrichestov (Moscow), no. 6, 1965 p 45–50
(AD-681811, FTD-HT-23-142-68) Avail: CFSTI CSCL 9/3

The article deals with the computational method of designing the inductor in question. The choice of the basic dimensions are first made, the aim being to assure the assigned volume of the magnetizing force. The data card should provide the geometrical dimensions. Experience and intuition are involved. The problem is stated with the proper formulas and the mathematical operations are explained. The pitfalls are pointed out. TAB

N69-21745# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
JOINT SERVICES ELECTRONICS PROGRAM Final Report, 1 Sep. 1966–31 Aug. 1968
Z. A. Kaprielian Aug. 1968 75 p refs
(Grant AF-AFOSR-486-67)
(AD-681527; AFOSR-69-0164TR; FR-4) Avail: CFSTI CSCL 9/1

The report describes the progress in the fields of solid state electronics, electromagnetics, plasmas, and information sciences. Author (TAB)

N69-21805# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC FREQUENCY ENCODER
S. M. Khyltchiev et al Jun. 1968 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), v. 10, no. 5, 1967 p 42–45
(AD-682180; FTD-MT-24-213-68) Avail: CFSTI CSCL 9/5

A frequency encoder is described in which the input signal frequency is converted to a pulse train with equal repetition frequency. The pulse train is applied to a pulse counter which counts the number of pulses per time unit (1 sec), providing a binary code equivalent to the input signal frequency. The counter consists of 22 stages: the first four utilize fast-switching P402 transistors, the next four utilize P14 transistors, and the remaining stages are of the core-transistor type. The parallel binary code at the counter output is converted to series code prior to transmission to a digital computer which controls the whole encoder. The frequency encoder range extends from 50 Hz to 4 MHz. Author (TAB)

N69-21876*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RATE AUGMENTED DIGITAL-TO-ANALOG CONVERTER
Sheldon Kopelson, inventor (to NASA) Filed 24 Oct. 1968 22 p
(NASA-Case-XLA-7828; US-Patent-Appl-SN-770209) Avail: CFSTI

A rate augmented digital-to-analog converter for computed time-dependent data is described. The converter produces a smooth continuous function by digitally incrementing functions samples at a rate proportional to a predicted functional change over each sample interval. The result is continuously converted to an analog voltage. The conversion produces an output which is, in effect, the sum of a linear ramp and the function sample. The converter input data are the computed sample and the change which is predicted by the solution of an nth-order extrapolation formula. The computer providing the function change information to the converter also solves the nth-order extrapolation formula. NASA

N69-21926*# Computer Control Co., Inc., Framingham, Mass.
TEST FIXTURE FOR PELLET-LIKE ELECTRICAL ELEMENTS
Anthony J. Nasuti, inventor (to NASA) Issued 14 Jan. 1969 (Filed 26 Oct. 1966) 4 p Cl. 324–158
(Contract JPL-951531)
(NASA-Case-XNP-06032; US-Patent-3,422,354; US-Patent-Appl-SN-590146) Avail: US Patent Office

The apparatus includes a block with a channel and pairs of spring-biased contact pins disposed perpendicular to the channel for receiving the elements to be tested. Insulators are positioned in the channel between each pair of contact pins, and a means is provided for applying compressive force to the contact pins, insulators and elements under test to insure adequate electrical contact. Office Gazette of the U.S. Patent Office

N69-21927*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COUPLING DEVICE
Elton M. Tucker, inventor (to NASA) Issued 14 Jan. 1969 (Filed 28 Dec. 1967) 6 p Cl. 339–91
(NASA-Case-XMS-07846-1; US-Patent-3,422,390; US-Patent-Appl-SN-694247) Avail: US Patent Office

Details are given on releasable coupling comprising a pair of telescopically engageable tubular shell members which are designed to receive and retain the mating ends of an electrical connector or other objects to be coupled. A plurality of locking balls are floatingly mounted in the wall of the outer shell member and are held captive by a locking sleeve assembled over the outer shell member. The sleeve is journalled for low-torque rotation on the outer shell and limited in rotary movement by mechanical stop means on the locking sleeve and outer shell member between a first unlock position wherein the balls are in registry with unlocking relief grooves in the inner wall of the locking sleeve, and a second position wherein the balls are cammed radially inward by the locking sleeve. Release is effected by longitudinal movement of the locking sleeve against the spring bias to release the cooperable latching means and then rotating to its unlocked position. A hermetic seal is provided between the shell members when they are in a coupled relationship. Official Gazette of the U.S. Patent Office

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-20712 New Mexico Univ., Albuquerque.
COMPENSATING TECHNIQUES FOR REDUCING THE RESPONSE OF TRANSISTOR CIRCUITS IN A TRANSIENT RADIATION ENVIRONMENT
Goebel Davis, Jr. (Ph.D. Thesis) 1968 229 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-11654

Methods of reducing the effects of γ radiation in transistor circuits are presented. The primary emphasis was upon the addition of back-biased junctions at selected circuit points. Approximating-equivalent circuits were developed for various circuits and methods of junction compensation, and theoretical predictions were made for the resulting peak value circuit responses during irradiation. Engineering-design hardening criteria in the form of approximate mathematical equations were developed which showed the required relationships between the circuit and device parameters. Some of the circuits were analyzed for transient-radiation response and certain selected hardened circuits were fabricated and experimentally tested under irradiation. Experimental results were compared to the theoretical and computer-predicted responses. Numerous compensation techniques were analyzed by the computer, theoretically evaluated, and experimentally tested. The use of an active transistor appears to be the most practicable. Dissert. Abstr.

N69-20722 Arizona Univ., Tucson.
MINIMIZATION OF SWITCHING CIRCUITS SUBJECT TO CONSTRAINTS
Ronald Clifford De Vries (Ph.D. Thesis) 1968 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-11832

A basic problem in logic design is minimization subject to constraints. The generalized prime implicant approach of Lawler provides the basis for extension to the constrained case. The concept of a prime implicant, similar to Lawler's prime implicant, was introduced. The question of the existence of the associative modification subject to input and level constraints was answered first. Theorems and lemmas introduced by Lawler for the free case were modified for the constrained case. Two new lemmas concerning existence were presented. Ways of determining absolutely minimal forms for a cost based on the number of gates, as opposed to literal cost used by Lawler, was given. A flow diagram was developed to provide the basis for a computer program for the method. Estimates of the complexity of the problems which can be solved on a modern digital computer are given. Dissert. Abstr.

N69-20733 Illinois Univ., Urbana.
AN APPROACH TO THE GENERAL SYNTHESIS OF A THRESHOLD ELEMENT NETWORK
Kenneth James Breeding (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-12086

This dissertation investigates an approach to the general synthesis of a network with threshold elements using approximating functions called minimal threshold approximations. The minimal threshold approximation or M function of a given switching function is a threshold function having the smallest set of true and false vectors which are false and true vectors respectively of the given switching function. A mixed integer linear programming formulation is given for the determination of M functions. Some of the algebraic properties which hold between a given function and an M function are investigated. A class of less restrictive approximations called T/M and F/M functions is investigated. A synthesis procedure is described for both forms of approximations. A subclass of the class of threshold functions, called simple functions, is investigated. Based on simple functions a test for threshold realizability is given. Dissert. Abstr.

N69-20740 Purdue Univ., Lafayette, Ind.
TIME OPTIMAL CONTROL FOR A CLASS OF COMMON RANDOM DISTURBANCES
Norval Peter Smith (Ph.D. Thesis) 1968 55 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-12621

This thesis concerns the time optimal control of a system variable where the controlling input to the system is bounded, as is normally the case in practice. Optimal control is defined here to be that control which yields optimal trajectories in the sense of minimizing the duration of the error response. It is shown that time optimal control also yields optimal trajectories in the sense of minimizing the maximum error (if this is the initial error, minimize the overswing next) and the number of oscillations. The problem of optimal control of a second order system initially in equilibrium and subjected to a large class of commonly occurring random disturbances is solved. A single control function is derived which suffices to yield optimal trajectories. Dissert. Abstr.

N69-20749 State Univ. of New York at Buffalo.
PREDICTOR SERVO SYSTEMS WITH RANDOM INPUTS
George P. Halsted (Ph.D. Thesis) 1968 206 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-11495

An investigation is made into the control of linear plants when the control variable is subject to saturation and the plant is to follow a random reference signal having stationary, gaussian statistics. Dynamic programming and the maximum principles are used to obtain differential equations which must be satisfied if the average value of a quadratic performance index is to be minimized. The obtainment of a solution to these equations appears very difficult. Empirical studies using an analogue computer show that the prediction concept has definite merit. However, it is found that if the rate gain is increased above that value which results from the minimum time rationale, a lower RMS error can be obtained. An attempt is made to develop a systematic method of synthesis for Smith's type of predictor servo. This investigation leads to a method of designing relay servos which combines optimum linear design technique with the Booton linear equivalent gain. Dissert. Abstr.

N69-20765 Stanford Univ., Calif.
OPTIMAL CONTROL OF SYSTEMS DESCRIBED BY DIFFERENTIAL-DIFFERENCE EQUATIONS
Dale Walter Ross (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11342

The optimal control of systems which are modeled by differential–difference equations is investigated. A Hamilton–Jacobi type sufficient condition for optimality is presented and applied to the case of a linear differential–difference equation system model, for which the associated performance criterion is quadratic in both state and control variables. The resulting analysis yields the optimal control in feedback form. This result generalizes the known results for the optimal control, relative to a quadratic criterion, of systems described by ordinary differential equations. The results are illustrated with an example concerning the control of a chemical process with transport lag present. The optimal feedback law parameters are computed and simulation results are presented. Dissert. Abstr.

N69-20858# Columbia Univ., Dobbs Ferry, N. Y. Hudson Labs.
DETECTION OF A POTENTIALLY SHIFTING SIGNAL PARAMETER
J. U. Farley and M. J. Hinich Jun. 1968 15 p refs
(Contract Nonr-266(84))
(AD-678910; CU-177-68-ONR-266-PHYS; TR-149) Avail: CFSTI CSCL 9/4

Parameter instability or non-stationarity in an input process is a potential problem for various signal processing schemes. In a processor, for example, which hard-clips the input, the clipping level must be at the true mean value of the signal in order to avoid severe distortion. A sudden shift in the mean can occur, however, if a large low-frequency transient is present in the signal or if a malfunction occurs in the electronics. Another non-stationarity problem in signal processing arises in matched filtering if there is a sudden change in the amplitude values of several Fourier components of a known signal waveform. If a change occurs, the old matching function is no longer optimal. The problems of a mean shift, a trend change, or an amplitude shift are special cases of the parameter shift problem in the general linear model. In this paper the detection of a shift of one parameter will be discussed. Author (TAB)

N69-20917 Texas Univ., Austin.
DESIGN OF ADAPTIVE CONTROL SYSTEMS THROUGH UTILIZATION OF SENSITIVITY CONCEPTS
Michael Keith Masten (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-10863

The problem of controller design for unidentified time variable systems is considered. The adaptive solution obtained does not identify the unknown plant; rather a low order linear tracker is determined whose behavior is near to that of the plant. The tracker characteristics are sufficiently similar to those of the plant so that controller synthesis based on the information gained from the tracker is assumed adequate for control of the plant. The tracker must be rapidly determined since the plant is time variable; time intervals for which the tracker is not an accurate approximation of the plant represent periods of inferior control. The adaptive rate at which the tracker is determined is considered and a scheme which will provide rapid adaption is developed. Dissert. Abstr.

N69-20918 Texas Univ., Austin.
OPTIMIZATION THEORY AND THE SYNTHESIS OF LINEAR SYSTEMS
Daniel Glenn Mackey (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-10861

This research is concerned with the investigation of techniques for the incorporation of design specifications into optimal control theory. The output regulator performance index is chosen specifically for study, and the resulting feedback controller has time-invariant elements. The characteristics of the optimal system are specified by selection of the performance index weighting matrix. This weighting matrix is used to calculate the gain matrix defining the

feedback controller. The closed-loop transfer function of the optimal system is used to select the weighting matrix elements on the basis of design criteria such as specified steady-state error. Systems designed in this manner are compared to those designed using the optimal tracking performance index, and an example is given. Specifying the closed-loop transfer function is seen to be a tedious technique for selection of the weighting elements when high order systems are considered. Dissert. Abstr.

N69-20919 Cornell Univ., Ithaca, N. Y.
COMPUTATION OF OPTIMAL AND SUBOPTIMAL PIECEWISE CONSTANT CONTROL FUNCTIONS
Robert Norman Lewine (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-11636

Application of the second variation descent search to the problem of computing optimal and suboptimal piecewise constant control functions is considered. It is shown that the structure of such control functions parameterizes the optimization problem. The search can thus be implemented by calculating the first and second partial derivatives of an appropriate performance index with respect to the parameters. The algorithm is shown to converge quadratically to the solution if the initial guess lies in the neighborhood about the solution point in which the second derivative matrix is positive definite. Techniques for producing a positive definite model for the second derivative matrix outside of this neighborhood are discussed. The effectiveness of these techniques is demonstrated in numerous test problems in which the search moves smoothly into the positive definite region from an arbitrary initial guess outside of this region. Dissert. Abstr.

N69-20961 Louisiana State Univ., Baton Rouge. Agricultural and Mechanical College.
OPTIMIZATION OF SYSTEM RESPONSE (VOLUMES 1 AND 2)
Alfred Moises Lopez, Jr. 1968 464 p
Avail: Univ. Microfilms: HC $20.95/Microfilm $5.90 Order No. 68-10748

Design techniques for conventional analog and digital feedback control systems were developed using minimum error integrals as criteria of performance. Graphs are presented to determine the optimum controller settings as a function of the process parameters for the continuous control of processes characterized by first-order lag with delay time and second-order lag with delay time models. It is shown that the use of these methods to tune conventional feedback controllers results in an improvement in control performance over the use of existing techniques. Optimum digital control algorithms with the discrete equivalent of proportional, proportional-integral, and three mode control are developed for processes whose dynamic characteristics can be satisfactorily approximated by the first-order lag with delay time model. Graphs are presented relating the optimum control settings to the process parameters and sampling period. Dissert. Abstr.

N69-20999# Toulouse Univ. (France). Faculté des Sciences.
A STUDY OF CONTROL SYSTEMS AT EXTREMES BY EXTRAPOLATION [ETUDE DE SYSTEMES DE REGULATION EXTREMALE PAR EXTRAPOLATION]
Heinrich G. Jacob 20 May 1968 366 p refs in FRENCH
Sponsored by Deut. Akad. Austauschdienst
Avail: CFSTI

The general problems encountered with process control systems at extremes are outlined. These systems, acting by extrapolation (iterative processes), are discussed and their performances are compared with more classical ones. Command algorithms are presented for systems in which there are no inertia inducing devices between the regulator and the active part of the system. Systems including inertia inducing devices are considered later for the case where first order linear operators are suitable for representing the inertia and they are generalised for inertia of any kind and any order. The influence of rapidly changing external perturbations is discussed and the results applied to systems subjected to rapidly changing linear or sinusoidal perturbations. The technical characteristics of three assemblies built with or without the use of analog or digital computers are described. ESRO

N69-21011 Texas Univ., Austin.
LINEAR AND NONLINEAR COMPENSATION OF CONTROL SYSTEMS CONTAINING MULTIPLE NONLINEARITIES
Roscoe Lee (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-10857

A new method for limit-cycle determination for feedback control systems containing multiple nonlinearities is discussed. The characteristics of the nonlinearities are replaced by the describing functions appropriate to each nonlinearity and the conditions under which these substitutions are valid are defined. The characteristic equation for the closed-loop system can be written incorporating these describing functions. A graphical method for the solution of the equation is formulated and a stability criterion applicable to the predicted limit cycles is derived. The proposed graphical method for limit-cycle determination has application to the compensation of the control system where compensation is defined as the elimination of limit-cycle behavior by the addition of an appropriate linear or nonlinear conpensating element. Dissert. Abstr.

N69-21029 Texas Univ., Austin.
LEARNING SYSTEMS FOR MINIMUM RISK ADAPTIVE PATTERN CLASSIFICATION AND OPTIMAL ADAPTIVE ESTIMATION
Charles Gene Hilborn, Jr. (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-10845

The two problems of unsupervised learning, sequential multicategory pattern classification and adaptive estimation of a sampled stochastic process, are jointly investigated. An unknown parameter model is developed which, for the pattern classification problem, allows for constant and time-varying unknown parameters, partially unknown probability laws of the hypotheses and time-varying parameter sequences, dependence of the observations on past as well as present hypotheses and parameters, and, most significantly, sequential dependencies in the observations arising from either (or both) dependency in the pattern or information source (context dependency) or in the observation medium (measurement correlation), these dependencies being up to any finite Markov orders. For the adaptive estimation problem, the same model is employed without any distinction between hypotheses and time-varying parameters. Dissert. Abstr.

N69-21089*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
OPTIMAL OUTPUT-FEEDBACK CONTROLLERS FOR LINEAR SYSTEMS
William S. Levine (Ph.D. Thesis) Feb. 1969 97 p refs
(Grant NGL-22-009(124))
(NASA-CR-100407; ESL-R-374) Avail: CFSTI CSCL 09C

This research is concerned with the optimal control of linear systems with respect to a quadratic performance criterion. The optimization problem is formulated with the additional constraint that the control vector is a linear function of the output vector rather than of the state vector. The optimal feedback matrix is then chosen to minimize an "averaged" quadratic performance criterion. The necessary conditions provided by the matrix minimum principle are used to determine the optimal feedback gain matrix. It is then shown to satisfy the Hamilton-Jacobi equation thereby

demonstrating that it is at least locally optimal. In addition, the existence of an optimal feedback gain matrix is proven. A computer algorithm is developed to facilitate the calculation of the feedback matrix for practical problems. This algorithm is programmed and used in the solution of several examples. Finally, a time-invariant version of the above problem is formulated and solved. Again an algorithm for computing a constant matrix is suggested. In addition, several examples are solved. Author

N69-21123*# National Aeronautics and Space Administration, Electronics Research Center, Cambridge, Mass.
A SUBOPTIMAL APPROXIMATION TO THE KALMAN FILTER
Leon Bess Washington Mar. 1969 28 p refs
(NASA-TN-D-5082) Avail: CFSTI CSCL 09C

A suboptimal estimation scheme similar to the Kalman filter is described which makes use of scalar weighting factors instead of matrix factors. It is shown that the accuracy degradation of the suboptimal estimator is not too great for most cases of practical interest. Moreover, it readily lends itself to physical interpretation. Author

N69-21228# LTV Electrosystems, Inc., Greenville, Tex.
DIGITAL PULSE REPETITION INTERVAL (PRI) FILTERING
Mar. 1969 12 p
(G3685.04.01A) Avail: Issuing Activity

Deinterleaving of pulse trains (separating combined pulse trains into the individual trains from which they were formed) is discussed. Some of the complications resulting from harmonic or near-harmonic ratios of PRF's are described, and the probability of false alarms is analyzed for simple cases. A technique for deinterleaving (filtering) by the use of digital devices is described, and some applications of this type of circuitry are discussed. Author

N69-21262 Iowa Univ., Iowa City.
DECOMPOSITION OF ASYNCHRONOUS SEQUENTIAL SWITCHING CIRCUITS
Larry Lee Kinney (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-10667

The problem in switching theory of decomposing a sequential circuit into an interconnection of several smaller sequential circuits is studied. This problem has been analyzed and several phases of it have been solved for synchronous sequential circuits. This study develops for the first time several similar procedures for asynchronous sequential circuits. One of the major results of this study is the definition of six types of interconnections of asynchronous circuits. A second major result is the derivation of necessary and sufficient conditions for decomposing a given asynchronous circuit into each of the six types. A third major result is the derivation of systematic and constructive procedures for making the decompositions. Most of the study is devoted to what has been called loop-free decompositions and the decomposition procedures have been discussed in detail. Then, also, some results have been obtained concerning non-loop-free decompositions. These last results are essentially a characterization of certain types of asynchronous state assignments. Dissert. Abstr

N69-21317# Toulouse Univ. (France). Faculté des Sciences.
CONTRIBUTION TO THE SPECTRAL ANALYSIS OF BACKGROUND NOISE IN TRANSISTORS AT VERY LOW FREQUENCIES [CONTRIBUTION A L'ETUDE DE L'ANALYSE SPECTRALE DU BRUIT DE FOND DES TRANSISTORS AUX TRES BASSES FREQUENCES]
Alain de Cacqueray (Ph.D. Thesis) 18 Jun. 1968 167 p refs
In FRENCH
Avail: CFSTI

The definitions of random noise and spectral analysis are discussed and the minimum time required to obtain the information on a signal with noise is calculated. A method of analysis suitable for very low frequencies is also developed. The different types of noise e.g. white noise, burst noise, shot noise and flicker noise, are considered in terms of noise temperature, noise factor and equivalent resistance on equivalent generator. The noise in injection transistors is computed by means of two equivalent generators and the optimum conditions for measurements in the very low frequency range are determined. Instruments for such measurements are described and their errors evaluated. It is shown that the observation time is in an inverse ratio to the band width of the filter used. Measuring times may be as long as 10 hours so special attention has to be paid to thermal stability. The designed circuit is suitable for the determination of equivalent generators with an accuracy of 0.001 Hz. ESRO

N69-21361 European Organization for Nuclear Research, Geneva (Switzerland).
GATING OF PHOTOMULTIPLIERS
W. Bartl 9 Dec. 1968 15 p refs
(CERN-68-41) Copyright. Avail: Issuing Activity

When we want to count particles using a photomultiplier (PM) after an intense illumination of its photocathode, we get a perturbation of the system. The PM becomes overloaded because of this big initial flash, and the gain is usually reduced. There are generally two kinds of perturbations. One occurs at the end of the multiplication system, mainly at the last dynode of the PM. But under certain conditions another kind of perturbation will already be created at the beginning of the system. It is a discharge of the photocathode. We call this effect paralysis and it will be considered in this paper, with particular emphasis on what one can do to eliminate it. Author

N69-21503# Microwave Associates, Inc., Burlington, Mass.
STUDY OF CYCLOTRON AND SYNCHRONOUS WAVE DEVICES Triannual Report, 1 Jul.–1 Oct. 1968
S. F. Paik, N. W. Harris, and R. J. Briggs Dec. 1968 44 p refs
(Contract DAAB07-68-C-0398)
(AD-681868; ECOM-0398-1) Avail: CFSTI CSCL 9/1

The purpose of the study was to demonstrate the feasibility of a high-power, high-efficiency transverse-wave amplifier. The interaction between the negative synchronous wave and the transverse circuit wave on a twisted structure was investigated in an earlier program. The theory of twisted slow-wave structures is reviewed and experimental results obtained are re-examined. The circuit study shows that there are several unwanted modes of propagation in the circuit previously used. The theory of the twisted circuit shows that each mode is made of many space harmonics traveling with different phase velocities. Spurious oscillations due to both the longitudinal and transverse-wave interactions may be explained considering interactions between various circuit modes (and space harmonics thereof), and beam waves. Author (TAB)

N69-21675# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPAL TASKS AND TRENDS IN THE DEVELOPMENT OF AUTOMATIC PROCESS CONTROL SYSTEMS
S. Dumler Aug. 1968 22 p refs Transl. into ENGLISH from Tr. Inzhenernoekon. Inst. (USSR), no. 23, 1966 p 38–52
(AD-681804; FTD-MT-24-245-68) Avail: CFSTI CSCL 13/8

The necessity is pointed out for automating process control because the man who makes decisions re: the process control is overloaded; the actual average load is 8–10 binary units per sec while the carrying capacity is only 20–25% of that. This overload causes (15–20%) losses connected with outrages and under

utilization of equipment. Automatic control systems are classified into: informational, information-advisory, information-control, and control systems. The control systems constructed or currently under development in the USSR are briefly reviewed. TAB

N69-21676# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MULTIPLEXING TELEMETRY OF MOCK-UPS IN MAGNETIC SUSPENSION [TELEMETRIE MULTIVOIES POUR MAQUETTES EN SUSPENSION MAGNETIQUE]
J. Beaussier and J. Zakheim [1968] 19 p refs In FRENCH Presented at the Colloq. on the Properties and the Behavior of Electronic Components and Ensembles Submitted to Great Acceleration, Saint Louis, France, 7–10 Oct. 1968
(ONERA-TP-643(1968)) Avail: CFSTI

Specifications for a multichannel telemeter for measurements on wind tunnel models in magnetic suspension included: six measuring channels, transmitting signal amplitude to vary between −20 and +100 mV, a pass band of 0 to 1,000 Hz, and an accuracy of 1%. The transmission mode chosen for the operation was frequency division multiplexing. The parameters to be measured are pressure, velocity, and thermal flux; the measuring gages are described. A description of the analog circuits, transmitter, and receiver is presented. Transl. by B.P.

N69-21849# Oak Ridge National Lab., Tenn.
SWITCHING TIME OF IDEALIZED REGENERATIVE CIRCUITS
James Manley Rochelle (M.S. Thesis) Oct. 1968 84 p refs
(Contract W-7405-eng-26)
(PB-180837; ORNL-TM-2288) Avail: CFSTI CSCL 09E

Results obtained describe the manner in which the switching time of idealized switching circuits varies as a function of the loop gain, bandwidth, trigger signal amplitude, and loop propagation delay time. The circuit models used are linear, first and second order gain functions connected in a unity positive feedback configuration with a step function input. The exponentially increasing output variable is assumed to be ideally limited at some final value which is directly proportional to the magnitude of the input step. As the input step becomes small relative to the output transition, the switching time approaches a limiting value which is a characteristic of the circuit only. This behavior is summarized in the noise trigger theorem. Author (USGRDR)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-20927*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SOLAR SIMULATOR USED FOR PRE-FLIGHT THERMAL QUALIFICATION OF THE RAE-A SPACECRAFT
Danny L. Lester and Roy McIntosh Feb. 1969 31 p refs
(NASA-TM-X-63492; X-713-69-67) Avail: CFSTI CSCL 14B

Extensive modifications were performed on the solar simulation facility in preparation for testing the RAE-A flight unit. The solar beam diameter was enlarged by almost 50 percent from 48 inches to 70 inches. This was accomplished by redesigning portions of the optical system and increasing the capabilities of other optical and mechanical components. The RAE-A was tested in the facility for 29 hours, and flight data is in close agreement with predictions made from the analytical model verified during the solar simulation test. Author

N69-21175# Regional Planning Council, Baltimore, Md.
THE GENERAL AVIATION AIRPORT: FACILITIES REQUIREMENTS AND OTHER CONSIDERATIONS
Robert S. Kaplan Jul. 1968 45 p refs
(PB-182128) Avail: CFSTI CSCL 13B

This report discusses the land and facilities requirements for the major types of general aviation airports, concepts of environment compatibility, and the economics of airport operation. Facility requirements and standards are specified in order to relate existing and projected general aviation activities to the need for physical facilities. Standards are developed for six categories of general aviation airports. The report describes the type of land uses that are compatible with the airport environment. The major costs and sources of income for the airport operator are described. Development costs, including the cost of land and the construction of improvements, are presented for each of the six categories. Separate estimates are made for flat and rolling terrain. Author (USGRDR)

N69-21189# Regional Planning Council, Baltimore, Md.
THE GENERAL AVIATION AIRPORT SYSTEM: A LOCATION ANALYSIS PROCESS
Robert S. Kaplan and William Ockert Oct. 1968 47 p Sponsored in part by the Dept. of Housing and Urban Develop.
(PB-182130) Avail: CFSTI CSCL 13B

This report describes an analytical approach that has been developed for use in planning a general aviation airport system to serve the Baltimore Region. Initially, facility requirements and standards are specified in order to relate existing and projected general aviation activities to the need for physical facilities. Development costs, including the cost of land and the construction of improvements, are presented for each of the categories specified. Because planning data with respect to general aviation use or future demand are virtually nonexistent, a survey of general aviation activity in the region was conducted to provide the necessary data base. This survey and its response are reported. Author (USGRDR)

N69-21257# Boeing Co., Seattle, Wash. Flight Sciences Lab.
DRIVER GAS CONTAMINATION IN SHOCK TUNNELS
J. Kenneth Richmond and R. J. Parsons Dec. 1968 19 p refs
(D1-82-0806) Avail: Issuing Activity

Shock tunnels are normally operated with flow times of many milliseconds, as indicated by an approximately constant reservoir pressure. This testing time is at a maximum under conditions of contact surface tailoring. It is shown how considerable amounts of driver gas can penetrate far into the test gas and contaminate the latter much sooner than the arrival of the bulk of the driver gas. Under certain conditions, this process can drastically shorten the constant properties testing time, without materially affecting the pressure. High speed gas sampling results confirm this phenomenon in a shock tunnel, and indicate the arrival of large concentrations of driver gas in less than half the time indicated by pressure records. A possible mechanism for premature arrival of driver gas, by bifurcation of the reflected shock, is described. Author

N69-21417# Technische Hogeschool, Eindhoven (Netherlands).
AN ELECTROLYTIC TANK FOR INSTRUCTIONAL PURPOSES REPRESENTING THE COMPLEX-FREQUENCY PLANE

P. Eykhoff, P. J. M. Ophey, J. Severs, and J. O. M. Ooms Sep. 1968 19 p refs
(TH-68-E-04) Avail: CFSTI

After some general observations with respect to the complex-frequency plane a description is given of an electrolytic tank representing this plane. This tank was constructed with educational purposes in mind. If the complex function H(s) (transfer-, impedance-, or admittance-function) is represented by current sources for its poles and by current sinks for its zeros then a potential proportional to log |H (s)| can be measured. The jω-axis, representing the real frequencies, can be scanned automatically. Using one of the Bode-relations a special instrumentation has been made which in addition provides arg H (jω) for minimum phase systems. Author

N69-21426# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
DESIGN OF A MULTIPURPOSE WIND TUNNEL
Gilbert D. Stein Dec. 1968 14 p refs
(Contract Nonr-609(47))
(AD-682226; TR-11) Avail: CFSTI CSCL 14/2

A continuously operating wind tunnel was designed for light scattering experiments in supersonic two-phase flow. Special features permit easy modifications of the equipment for a variety of studies. Author (TAB)

N69-21540*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUPPORT TECHNIQUE FOR VERTICALLY ORIENTED LAUNCH VEHICLES
Robert W. Herr, inventor (to NASA) Issued 14 Jan. 1969 (Filed 1 Jul. 1965) 5 p Cl. 73-67.2
(NASA-Case-XLA-02704; US-Patent-3,421,363; US-Patent-Appl-SN-469011) Avail: US Patent Office

A restraint harness for a vertically oriented, long slender body is described. A support structure has support cables tied to it and to the body being supported. The support cables are located entirely below the center of gravity of the body. Restraint cables are connected to the body at points above the center of gravity of the body, entrained over pulleys anchored to the support structure, and fixed to the support cables completing the harness. Official Gazette of the U.S. Patent Office

N69-21748 European Organization for Nuclear Research, Geneva (Switzerland).
STUDY OF TEMPORAL REPARTITIONS IN THE SYNCHRO-CYCLOTRON GROUP [ETUDE DES REPARTITIONS TEMPORELLES DANS LES FAISCEAUX DU SYNCHRO-CYCLOTRON]
Ph. Levy 1968 38 p refs In FRENCH
(CERN-68-43) Copyright, Avail: Issuing Activity

Two types of distributions are studied: the exact temporal distribution of events and the distribution of variations separating two events. Methods used for measuring the distribution in time, distribution of variations, gross duty cycle, and total duty cycle are described. The short burst and the phenomena involved in slow extraction are discussed for both the gross structure and the fine structure. Oscilloscopic observation and time of flight analysis are used to calculate the spectrum of radial betatron oscillation amplitude. The limits of different duty cycles, defined as classical, slow classical, stochastic, and diffused classical regulation, are presented. The role of the amplitude of radial oscillations which determine the choice of all the frequencies is noted. Possibilities of using the study results for improvement of the system, including implications for a new synchrocyclotron project, and other ways in which temporal analysis could be utilized are discussed. Transl. by P.A.B.

N69-21808# Metaalinstituut TNO, Delft (Netherlands).
PART A: INSPECTION OF WORK STATIONS. 3. INSPECTION OF THE PAINT-SPRAY SHOP AND THE WASH STATION AT THE VALKENBURG NAVAL BASE [DEEL A–DE DOORLICHTING VAN DE WERKPLAATSEN. III. DE DOORLICHTING VAN DE SPUITERIJ MET SCHOOMAAKAFDELING OP DE MARINEBASIS VALKENBURG]
29 Nov. 1968 7 p In DUTCH
(M68-913; TDCK-5246(3)) Avail: CFSTI

These work areas are used for surface treatment and painting of aircraft parts within the daily and three-monthly maintenance routine. The work process consists of paint removal with solutions; water rinses, grease removal, steam cleaning, anticorrosion treatment, sandblasting, chromate treatment, drying, spray-painting, and waxing. Findings and recommendations to improve work methods, equipment, temperature control, ventilation, and safety measures are presented. Transl. by K.W.

N69-21807# Metaalinstituut TNO, Delft (Netherlands).
INSTRUCTIONS REGARDING THE PERCHLOROETHYLENE BATH IN THE TECHNICAL SECTION OF THE NAVAL AIR STATION AT DEN HELDER [EEN ADVIES BETREFFENDE HET PERCHLOORETHYLEENBAD VAN HET MARINE LUCHTVAART TECHNISCH BEDRIJF TE DEN HELDER]
15 Jul. 1968 3 p In DUTCH
(M68-560; TDCK-51365-III) Avail: CFSTI

The perchloroethylene vapor is used for grease removal from aircraft parts. The facility was inspected following complaints from workers that an excessive amount of the vapor escaped from the system. Instructions regarding location of the containers, improved cooling, ventilation, and handling of the fluid are given based on a gas analysis and air flow measurements. Transl. by K.W.

N69-21809# Metaalinstituut TNO, Delft (Netherlands).
INSTRUCTIONS FOR THE VENTILATION OF A SANDBLASTING FACILITY IN THE TECHNICAL SECTION OF THE NAVAL AIR STATION RIJKSWEG 20 AT DAR HELDER [EEN ADVIES BETREFFENDE DE AFZUIGING VAN EEN GLASSTRAALINRICHTING VAN HET MARINE LUCHTVAART TECHNISCH BEDRIJF RIJKSWEG 20 TE DEN HELDER]
L. Drenth 2 Aug. 1968 4 p In DUTCH
(M68-587; TDCK-51408-III) Avail: CFSTI

The blasting equipment in this facility is used for cleaning aircraft parts. A study was conducted of the flues for drawing off the blasting media and of the ventilation equipment. At present the facility is equipped with a spool brush for cleaning cylinders, an aluminum oxide blast cabin, a Pangborn wet glass-particle blast cabin, and an apparatus for blasting with cherry pits. The flow velocities and the capacities of the various flues and ventilators were measured. Recommendations are presented for the existing equipment and for the proposed installation of a dry steel-particle blast apparatus and a dry glass-particle blast apparatus for cleaning engine blocks. Transl. by K.W.

N69-21812# Metaalinstituut TNO, Delft (Netherlands).
PART A: INSPECTION OF WORK PLACES. 2. INSPECTION OF THE SECTION FOR SURFACE TREATMENT OF THE AVIOLANDA N.V. AT TE WOENSDRECHT [DEEL A-DE DOORLICHTING VAN WERKPLAATSEN. 2. DE DOORLICHTING VAN DE AFDELINGEN VOOR OPPERVLAKTEBEHANDELING BIJ AVIOLANDA N.V. TE WOENSDRECHT]
29 Nov. 1968 7 p refs In DUTCH
(M68-910; TDCK-5246-III) Avail: CFSTI

The inspected work areas are located in an aircraft hanger and include cleaning and painting shops. As a part of routine

maintenance work, small- and medium-sized aircraft parts are surface-treated, and large parts as well as entire fuselages are painted. The treatment of the parts variously consists of grease removal, rinsing, steam cleaning, cauterizing, chromate treatment, and drying. The painting operations involve paint removal with solvents, rinsing, anticorrosion treatment, and spray-painting. Findings and recommendations regarding work methods, ventilation, and safety measures are given in this report. Transl. by K.W.

N69-21813# Metaalinstituut TNO, Delft (Netherlands).
PART A: INSPECTION OF WORK PLACES. 1: INSPECTION OF THE SURFACE CLEANING SHOP AND THE PAINT SHOP IN THE TECHNICAL SECTION OF THE NAVAL AIR STATION DE KOOY AT DEN HELDER [DE DOORLICHTING VAN HET SCHOONMAAKBEDRIJF EN DE LAKKERIJ VAN DE MLTB OP HET VLIEGKAMP DE KOOY TE DEN HELDER]
25 Nov. 1968 9 p In DUTCH
(M68-904; TDCK-52463-III) Avail: CFSTI

These shops are operated for routine care and maintenance of aircraft. The work performed in the cleaning shop includes removal of paint, rinsing, and steam cleaning; in the paint shop, work consists of grease removal with solvents, anticorrosion treatment, rinsing, chromate treatment, drying, and painting with primers and acryl–nitrocellulose lacquers. Findings and recommendations to improve work methods, ventilation, temperature control, and safety measures are presented in this report. Transl. by K.W.

N69-21831# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INSTALLATION AND METHOD FOR CONDUCTING EXPERIMENTS TO DETERMINE FATIGUE LIMITS OF PIPELINE CONNECTIONS IN AIRCRAFT HYDRAULIC SYSTEMS
L. P. Lozitskii, A. A. Ivanenko, and B. Ya. Kudryashov Jan. 1968 17 p refs Transl. into ENGLISH from Samoletostroenie i Tekh. Vozdushnogo Flota (USSR), no. 6, 1966 p 82–89
(AD-682158; FTD-MT-24-377-67) Avail: CFSTI CSCL 14/2

The authors describe a unit designed for studying the effect which internal fluid pressure, inaccuracies in assembly, vibration loads due to the power plant and pumps, and other factors have on the fatigue strength of pipeline connections in aircraft hydraulic systems. The procedure used for checking the fatigue strength of pipeline couplings is described in detail. The unit may be used for testing connections under conditions close to operational for long periods with sufficient accuracy for practical purposes. TAB

N69-21862# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
ON SHOCK-TUNNEL SIMULATION OF SCRAMJET COMBUSTION CHAMBER PERFORMANCE
J. Kenneth Richmond, R. J. Parsons, and J. Swithenbank (Sheffield Univ., England) Nov. 1968 29 p refs Sponsored in part by AE, Min. of Tech. and Sci. Res. Council
(AD-682127; DI-82-0804) Avail: CFSTI CSCL 21/2

The combustion-driven shock-tunnel can supply flows with the static temperatures, static pressures, and velocities required for simulation of scramjet combustion chamber conditions for flight Mach numbers up to 15. Limitations of the shock tunnel include the difficulty of attainment of a steady, equilibrium flow of pure air, free of driver gas contamination. In a British shock tunnel facility, a high speed sampling valve, probe, and gas analyzer were applied to the flow at the exit of a M = 3 nozzle, with stagnation pressure = 100 atmospheres and stagnation temperature = 6000 deg K, with coaxial hydrogen injection. Author (TAB)

N69-21868# Cambridge Electron Accelerator, Mass.
OPERATION OF THE CAMBRIDGE ELECTRON ACCELERATOR FOR FISCAL YEARS 1968, 1969, AND 1970
Karl Strauch 1 May 1968 39 p refs Prepared in cooperation with MIT
(Contracts AT(30-1)-2076; AT(30-1)-3025)
(PB-180831; CEAL-1041) Avail: CFSTI CSCL 20G

The two primary tasks of the Cambridge Electron Accelerator are (1) operations, improvement, and development of the 6-BeV electron synchrotron facility, and (2) support of an experimental program in particle physics. The aim is to carry out these tasks so as to combine excellence in research with the training of a large number of professional physicists. The 6-BeV electron accelerator furnishes several external beams of 1 to 6 BeV electrons and bremsstrahlung. Internal targets are also used. Two tagged photon beams and two polarized beams exist or are being developed. Author (USGRDR)

N69-21912# National Bureau of Standards, Boulder, Colo.
CALIBRATION OF A KERR CELL SYSTEM FOR HIGH VOLTAGE PULSE MEASUREMENTS Final Report
Esther C. Cassidy and H. N. Cones Albuquerque, N. Mex. Sandia Corp. Aug. 1968 53 p refs Sponsored by AEC Prepared for Sandia
(PB-180864; SC-CR-68-3730) Avail: CFSTI CSCL 20F

The following are included: Systems for purification and testing of the nitrobenzene used in our Kerr cells were developed. Methods for calibration of a Kerr system by reference to calibrated pulse divider measurements are given. These calibrations are believed to be accurate to better than 1%. Methods for independence under both uniform and nonuniform field conditions were developed and evaluated. Pulse voltages as high as 100 kV were measured (simultaneously) by use of a calibrated pulse divider and a Kerr system. Several different Kerr cells were used. With further refinements, it is anticipated that such calibrations, accurate to within plus or minus 0.5% will be feasible for systems capable of time-resolved measurements of pulses as high as 300 kV. Author (USGRDR)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-20704# Naval Ordnance Lab., White Oak, Md.
COMPUTER CODE FOR CALCULATING ONE-DIMENSIONAL FLOW
John O. Erkman and David J. Edwards Nov. 1968 17 p refs
(AD-681377; NOLTR-68-160) Avail: CFSTI CSCL 20/4

The report describes the implementation of the computer code Wondy for one-dimensional hydrodynamic computations. The code was put into Fortran IV form for use on the IBM 7090 computer. The code was selected because it is adequately documented and because it handles problems involving elastoplasticity, porosity, fracture, and release of the reaction energy of explosives. The code is expected to be useful in simulating, designing, and interpreting experiments. Author (TAB)

N69-20718# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
CONE CAVITY FLOW AT M = 8.3 WITH INJECTION OF LIGHT, MEDIUM AND HEAVY GASES. LAMINAR SEPARATION AT HYPERSONIC SPEEDS Final Scientific Report, 1 Oct. 1967–30 Sep. 1968

Jean J. Ginoux and Felix Thiry Nov. 1968 52 p refs
(Grant AF-EOAR-68-003)
(VKN-TN-35) Avail: CFSTI

The effect on the reattachment pressure and heat transfer peaks of injection of air and foreign gases into the separated region of the laminar flow over a cone cavity model has been investigated at M = 5.3. Injection has generally a favorable effect in reducing these peaks, light gases being more effective. A correlation factor is given to relate together the effects of various gases. A surprizing similarity is found with theoretical and experimental results for unseparated flows over porous walls. Occasionally, very high frequency flow unsteadiness has been observed. Author (ESRO)

N69-20738 City Univ. of New York.
STOCHASTIC MIXING MODELS FOR CHEMICAL REALTORS
Frederick J. Krambeck (Ph.D. Thesis) 1968 224 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-11222

Turbulent flow systems that serve as chemical reactors are modeled by a network of well-mixed tanks with interconnecting flows that vary in time as stationary Markov processes. A study of the mathematical description of such models with the number and arrangement of tanks left unspecified is used to relate the statistics of tracer experiments performed with randomly fluctuating systems to the probability structure of the random passage of a single fluid particle through the system, and to the statistics of the system's behavior with a first-order isothermal chemical reaction. Some simple examples of such models are then studied in detail, illustrating the effects that can result from stochastic mixing. Dissert. Abstr.

N69-20762 Illinois Univ., Chicago.
FLAT PLATE-FREE JET IMPINGEMENT STUDIES
Ralph Barry Gilbert (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-12127

The equations governing axisymmetric, inviscid, isenthalpic, steady, rotational motion have been combined with the Rankine–Hugoniot shock relations and numerically integrated by the method of characteristics in an IBM 7094 digital computer program to predict the wave structure comprising the first shock bottle in slightly underexpanded free jets. A zero radial pressure gradient condition was imposed on the subsonic portion of the jet to locate a triple shock point in the flow field. Calculations were continued downstream until the slip-stream minimum radius point was determined. Theoretical and experimental studies of slightly underexpanded free jets and of flat plate–free jet impingement phenomena have been conducted. It was concluded that both the jet wave structure and the gross properties in the immediate vicinity of the plate centerline impingement point could be accurately predicted by the theoretical model used. Dissert. Abstr.

N69-20771 Rochester Univ., N. Y.
A WAVY WALL BOUNDARY LAYER STABILITY IN COMPRESSIBLE FLOW AND WITH HEAT TRANSFER
Jau-Fu Hwang (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-9376

The stability of the compressible boundary layer along a curved wall under Taylor–Goertler type disturbances is investigated by the method of small perturbations. The chief emphasis is placed on the effects of wall cooling and pressure fluctuation on the neutral stability. A perturbation method for the calculation of the compressible laminar boundary layer with heat transfer over a wavy wall is described. It supplies the steady basic flow solution for the stability analysis. The method utilizes a modified Fourier series for the pressure fluctuation due to the undulation of the wall. It is shown that, for any given free stream Mach number, wall cooling stabilizes the flow; for a fixed heat transfer rate, the stability decreases as the Mach number increases; and an adverse pressure gradient destabilizes the flow. Dissert. Abstr.

N69-20786# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SIMILARITY PROPERTIES OF THE LAMINAR OR TURBULENT SEPARATION PHENOMENA IN A NON-UNIFORM SUPERSONIC FLOW [PROPRIETES DE SIMILITUDE DES PHENOMENES DE DECOLLEMENT LAMINAIRE OU TURBULENT EN ECOULEMENT SUPERSONIQUE NON UNIFORME]
Pierre Carriere, Maurice Sirieix, and Jean-Louis Solignac 1968 29 p refs In FRENCH; ENGLISH summary Presented at the 12th Intern. Congr. on Appl. Mecan., Stanford Univ., Gt. Brit., 26–31 Aug. 1968 Submitted for publication
(ONERA-TP-859F) Avail: CFSTI

The phenomenological analysis of Chapman and al., established for a plan and uniform supersonic flow upstream of separation, is extended to the case of a non-uniform, plane or axi-symmetrical, supersonic flow. Generalized similarity functions are thus defined ; they emphasize a very satisfactory correlation between the experimental results obtained, at O.N.E.R.A. among others, either in laminar or in turbulent flow, within a wide range of Mach and Reynolds numbers. The determination of the length characterizing the extent of the domain within which these similarity properties apply is especially examined. Author (ESRO)

N69-20794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FLOW RATE ON THE DYNAMIC CONTACT ANGLE FOR WETTING LIQUIDS
Thom A. Coney and William J. Masica Washington Mar. 1969 22 p refs
(NASA-TN-D-5115) Avail: CFSTI CSCL 20D

Experimental measurements were made of the dynamic contact angle over a previously wetted liquid surface as a function of interface velocity and liquid properties. The experiments were conducted in a weightless environment using glass tubing with a rectangular cross section. All liquids exhibited zero degree static contact angles. The study showed that existing theory adequately predicted the contact angle dependence on interface velocity and liquid properties. In addition, qualitative agreement was obtained between the theoretical and experimental interface shapes. Author

N69-20805# Wisconsin Univ., Madison. Mathematics Research Center.
A NEW SYSTEMATIC FORMALISM FOR SIMILARITY ANALYSIS, WITH APPLICATIONS TO BOUNDARY LAYER FLOWS
M. J. Moran, R. A. Gaggioli, and W. B. Scholten Aug. 1968 75 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681404; MRC-TSR-918) Avail: CFSTI CSCL 12/1

A new systematic formalism is presented for similarity analysis -- i.e., for reducing the number of independent variables in systems consisting of partial differential equations and a set of auxiliary conditions. The formalism, which is a specialization of previous group theory techniques developed by the authors, is easier to use for practical similarity analyses. Concurrent with its presentation, and to illustrate that it is particularly well suited for practical similarity analyses, the formalism is applied to certain three-dimensional incompressible boundary layer flows. A variety of results are elicited which are somewhat more general than any previously reported for the class of flows considered. Author (TAB)

N69-20821 Illinois Univ., Urbana.
WALL SHEAR STRESS DISTRIBUTION FOR FLOW AROUND A CIRCULAR CYLINDER – 60 < RE < 340 –
Haralambo Dimopulos (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-12106

Although the problem of calculating the shear stress distribution around a circular cylinder had received considerable attention, no direct measurements have been reported. One of the reasons for this is that instruments for measuring the shear stress are limited because of the difficulties involved in their calibration or because of the relatively large size of the transducer. A new electrochemical method which does not have these shortcomings has been used to study flow around a circular cylinder over the Reynolds number range of 60 – 340. These have allowed a direct examination of the validity of the boundary layer theory and of some aspects of the flow in the wake. The method makes use of an electrode mounted flush on the cylinder surface. Dissert. Abstr.

N69-20825 Washington Univ., Seattle.
STUDIES IN THE KINETIC THEORY OF FLUIDS
Richard Shih-Chau She (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-12717

A classical mechanical kinetic theory of dilute gases is developed for molecules having arbitrary degrees of freedom and interacting according to an arbitrary potential. The Boltzmann equation for the truncated singlet distribution function is derived by application of a general form of the divergence theorem, and the equilibrium solution is obtained from an H-theorem for the fluid. The solution of the Boltzman equation by a procedure of the Chapman–Enskog type is described for the case of molecules having translational and rotational degrees of freedom. In the second part a new approach to the kinetic theory of liquids is developed on the basis of the physical picture of the inner group model. Dissert. Abstr.

N69-20839# Wisconsin Univ., Madison. Mathematics Research Center.
SIMILARITY FOR A REAL GAS BOUNDARY LAYER FLOW
M. J. Moran and R. A. Gaggioli Aug. 1968 16 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681405; MRC-TSR-919) Avail: CFSTI CSCL 12/1

New results for a real gas compressible boundary layer flow are obtained, by applying recent group theory techniques for reducing the number of independent variables. In particular, the results are obtained without assumptions about the functions of state (which, say, relate pressure, specific heat, viscosity and thermal conductivity to the temperature and density). Author (TAB)

N69-20851 Houston Univ., Tex.
LIQUID FILM CHARACTERISTICS IN VERTICAL TWO-PHASE FLOW
Affonso Carlos da Silva Telles (Ph.D. Thesis) 1968 284 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 68-11151

The motion of a liquid film falling under the action of gravity and of a co-current gas flow, was investigated. The fact that all processes arising in such a system are stochastic, induces the use of statistical parameters do escribe the flow. The probability distribution and spectral density of the interface were measured and used to obtain the average characteristics of wave separation, wave propagation velocity, and wave profile. The spectral density of wall pressure fluctuations were measured and used to estimate the average force on the liquid, assignable to those fluctuations. Using a model it was shown to be possible to obtain an approximate solution of the boundary layer equations to describe the stochastic motion of a laminar liquid film. Dissert. Abstr.

N69-20880# RAND Corp., Santa Monica, Calif.
ACOUSTIC-GRAVITY WAVES FROM AN ENERGY SOURCE AT THE GROUND IN AN ISOTHERMAL ATMOSPHERE
J. D. Cole and C. Greifinger Dec. 1968 37 p refs
(Contract DAHC15-67-C-0141)
(AD-681379; RM-5828-ARPA/AFT) Avail: CFSTI CSCL 18/3

An analysis is given by two different methods--stationary phase and kinematic theory--of the pressure pulse generated by a nuclear explosion near the ground in an isothermal atmosphere. The present study builds upon work reported earlier. The shape of the signal is shown as a function of time at several distances from the source for a fixed altitude, and at several altitudes for a fixed lateral distance. The first signal to arrive at any location is a high-frequency acoustic wave, followed by a low-frequency acoustic-gravity wave. The onset of the latter is marked by a sharp front, or caustic. At any instant after the arrival of the caustic there are three principal frequency components at any location, the lowest of which becomes dominant as time progresses. It is shown how the qualitative features of the flow, as well as the exact location of the caustic, can be obtained from kinematic theory. TAB

N69-20887 Ohio State Univ., Columbus.
ELASTIC AND THIXOTROPIC INTERPRETATION OF TRANSIENT NON-NEWTONIAN FLOW
William Ernest Lewis (Ph.D. Thesis) 1968 164 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-12853

The phenomenological theory developed by Brodkey and co-workers has been coupled with a simple Maxwellian stress retardation model to describe transient and equilibrium shear stress for constant rates of shear. It is assumed that the measured stress at constant shear rate is the product of the thixotropic stress and an elastic retardation term. To test the validity of the theory, transient and equilibrium shear stress at constant shear rate data have been obtained for 47 weight per cent polymethylmetacrylate in diethylphthalate at 40° C using a Weissenberg rheogoniometer. The standard deviation between the experimental data and the calculated results is 6 per cent for a shear rate range of 10^{-3} to 28 sec^{-1}. This range of shear rates encompasses both conditions where stress overshoot is observed and conditions where no stress overshoot occurs. Dissert. Abstr.

N69-20908 Case Western Reserve Univ., Cleveland, Ohio.
A STUDY OF RADIAL MIGRATION IN FLUID-PARTICLE FLOWS WITH FLUID ROTATION
Martin Timothy Lawler (Ph.D. Thesis) 1967 348 p
Avail: Univ. Microfilms: HC $15.75/Microfilm $4.45 Order No. 68-10168

This thesis is concerned with the motion of small solid particles suspended in a flowing fluid. Particular attention is devoted to situations where radial migration occurs. A model for the lift force acting on a single spherical particle is developed and applied to the problem of determining single particle trajectories in a rotating pipe. The problem is formulated and trajectories are obtained by numerical solution of the equations of motion. The lift force model is incorporated into a continuum description of the flow of a dilute fluid-particle mixture. The equations of motion for the carrier fluid and the particle cloud are obtained and applied to the analysis of such a flow in the entrance region of a slowly rotating pipe. The problem is simplified and pertinent dimensionless parameters are obtained. The simplified problem is solved by Laplace transform techniques and the various velocity, pressure and concentration fields are obtained. Dissert. Abstr.

N69-21025 Stanford Univ., Calif.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: AN EXPERIMENTAL STUDY OF THE FLUID DYNAMICS WITH INJECTION AND SUCTION
Roger Lyndon Simpson (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-11349

Mean velocity profile data are reported for blown, unblown, and sucked incompressible turbulent boundary layers in a constant velocity freestream of 44 fps. The X-Reynolds numbers range from 4×10^5 to 2×10^6 with five different distributions of the blowing or suction fraction $\dot{m}''/G$: (1) uniform $\dot{m}''/G$ with $-0.0076 \leq \dot{m}''/G \leq 0.0095$, (2) $\dot{m}''/G$ varying along the plate as $cx^{-0.2}$, (3) $\dot{m}''/G$ varying along the plate as cx, (4) $\dot{m}''/G$ varying along the plate as $cx^{-0.5}$, and (5) steps in uniform $\dot{m}''/G$. The friction factor was found to be a unique function of the local momentum thickness Reynolds number and the local blowing or sucking conditions, providing that $\dot{m}''/G$ varied slowly along the plate. The velocity distribution near the wall can be expressed in a similarity law of the wall form for suction and blowing, provided that $\dot{m}''/G$ is slowly varying. Dissert. Abstr.

N69-21039*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
APPROXIMATE CALCULATION OF THE CRITICAL ATTACHMENT AND SEPARATION PRESSURES OF THE TURBULENT BOUNDARY LAYER IN SUPERSONIC FLOW [PRIBLIZHENNYY RASCHET KRITICHESKIKH DAVLENIY PRIBOYEDINENIYA I OTRYVA TURBULENTNOGO POGRANICHNOGO SLOYA V SVERKHZVUKOVOM POTOKE]
L. V. Gogish Washington NASA Mar. 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 4, 1968 p 103–108
(Contract NASw-1692)
(NASA-TT-F-12132) Avail: CFSTI CSCL 20D

An integral method is proposed for calculating the critical pressure ratios connected with the attachment and separation of the turbulent boundary layer in supersonic flow. The calculation is based on the application of the conservation equations to the control cross sections of the nominal beginning and end of the attachment or separation region. Friction and mixing in these regions of viscous flow are disregarded. The real characteristics of the process of pressure increase during attachment (the compression wave) and separation (discontinuity) are taken into account. Author

N69-21052# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
FAR FIELD APPROXIMATION FOR A NOZZLE EXHAUSTING INTO A VACUUM
J. Brook Mar. 1969 13 p refs Submitted for publication
(RM-442J) Avail: Issuing Activity

An analytical method for obtaining density profiles in the far field of the plume is described, for the purpose of more accurately predicting forces resulting from plume impingement. Difficulties associated with a method of characteristics description of the far field and previous attempts to evade these difficulties by approximate analytical methods directed specifically to the far field are discussed. A modification of a Hill and Draper profile is presented, which allows matching of the axial density and conserves mass and momentum flux. Terms relating to the local pressure and to the difference between the velocity on the axis and the maximum velocity are retained. Velocity and pressure corrections are calculated. The present method agrees well with the characteristics calculation. P.A.B.

N69-21098*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
DYNAMICS AND STABILITY OF FERROFLUIDS: SURFACE INTERACTIONS
R. E. Zelazo and J. R. Melcher Dec. 1968 48 p refs
(Grant NGL-22-009-014)
(NASA-CR-100446; CSR-TR-68-12) Avail: CFSTI CSCL 20D

A general formulation of the incompressible ferrohydrodynamics of a ferrofluid with nonlinear magnetization characteristics is presented which distinguishes clearly between effects of inhomogeneities in the fluid properties and saturation effects from nonuniform fields. The formulation makes it clear that with uniform and nonuniform fields the magnetic coupling with homogeneous fluids is confined to interfaces; hence it is a convenient representation for surface interactions. Detailed attention is given to waves and instabilities on a planar interface between ferrofluids stressed by an arbitrarily directed magnetic field. The close connection with related work in electrohydrodynamics is cited, and emphasis is given to the effect of the nonlinear magnetization characteristics on oscillation frequencies and conditions for instability. The effects of nonuniform fields are investigated using quasi-one-dimensional models for the imposed fields in which either a perpendicular or a tangential imposed field varies in a direction perpendicular to the interface. Author

N69-21108*# Aztec School of Languages, Inc., Acton, Mass.
FLOWS IN JETS EXPELLED FROM UNDEREXPANDED NOZZLES [TECHENIYE v ISTEKAYUSHCHIKH iz NEDORASSHIRENNYKH SOPEL STRUYAKH]
V. N. Gusev and T. V. Klimova Washington NASA Mar. 1969 9 p refs Transl. into ENGLISH from Iz. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, 1968 p 121–125
(Contract NASw-1692)
(NASA-TT-F-12131) Avail: CFSTI CSCL 20D

Plane and axisymmetric hypersonic jet flows of an ideal gas are treated as flows in infinitely thin gas layers, the density of which is substantially greater than the ambient density. An expression for the pressure difference Δp across a compressed layer is obtained in the form $\Delta p = qU_m/N$ where q is the flow rate per unit length, U_m is the maximum gas velocity in the gas layer, and N is the radius of curvature of the layer. The equation is used as a basis for calculating the flow in jets expelled from underexpanded nozzles. Author

N69-21112*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
ELECTROCONVECTIVE INSTABILITY IN A FLUID LAYER
D. C. Jolly and J. R. Melcher 4 Feb. 1969 18 p refs
(Grant NGL-22-009-14)
(NASA-CR-100455; CSR-TR-69-2) Avail: CFSTI CSCL 20D

Steady flows of a fluid of slight electrical conductivity under the influence of an applied electric field intensity are often unstable. A study is described to illustrate with experiments and an analytical model the fundamental aspects of a wide range of instabilities that are characterized by the incipience of steady cellular convection as the electric Hartmann number is on the order of unity. A nonuniform electric field is used to induce an unstable configuration of surface charge and electric field intensity at a planar interface. The resulting instability leads to cellular convection in the plane of the interface. Predictions of the electric Hartmann number and wavelength for incipience of instability compare favorably to measurements. The dependence of the measured cellular convection velocity, resulting from the instability, on electric Hartmann number and electric Reynolds number are also in satisfactory agreement with the predictions from the simple model. Author

N69-21128# Royal Aircraft Establishment, Farnborough (England).
THE EXISTENCE OF SUPERSONIC ZONES IN THREE-DIMENSIONAL SEPARATED FLOWS [O SUSHCHESTVOVANII SVERKHZVUKOVYKH ZON V PROSTRANSTVENNYKH OTRYVNYKH TECHENIYAKH]
D. M. Voitenko et al May 1968 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1967 p 20–24
(RAE-Lib-Trans-1302) Avail: CFSTI

The flow in front of a cylinder mounted on a flat plate in a supersonic stream at M = 3.11 was investigated using pitot and static pressure measurements together with shadow and surface flow photographs. The existance of local supersonic zones near the subsonic reversed flow in the separated region at the base of the cylinder was confirmed and explained by the three dimensional nature of the flow. Mach numbers of the order of 1.25 were detected in this region. A model is given indicating the shock wave structure and the nature of the flow past the cylinder.
Author

N69-21129*# Aztec School of Languages, Inc., Acton, Mass.
INVESTIGATION OF THE EJECTING ACTION OF A TURBULENT JET BY THE ELECTRODYNAMIC SIMULATION METHOD [ISSLEDOVANIYE EZHEKTIRUYUSHCHEGO DEYSTVIYE TURBULENTNYKH STRUY METODOM ELEKTROGIDRODINAMICHESKOY ANALOGII]
G. T. Aldoshiv and G. V. Gindin Washington NASA Mar. 1969 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Aviats. Tekhn. (USSR), no. 1, 1968 p 141–145
(Contract NASw-1962)
(NASA-TT-F-12136) Avail: CFSTI CSCL 20D

The authors describe the electrodynamic simulation of the flow of fluid toward a turbulent gas jet due to the ejection of matter by the jet moving in the ambient medium. The problem of the flow of fluid toward a turbulent jet involves the solution of the Laplace equation for the stream function. The motion of electric current in an electrically conductive layer of constant thickness and constant resistivity is also described by a Laplace equation for the electric potential under corresponding boundary conditions. A technique of simulating the flow toward the turbulent jet by electrodynamic means using an electrically conducting paper is described. Two practical examples of flow simulation using the proposed technique are given.
Author

N69-21131*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DIFFRACTION EFFECTS DURING THE PASSAGE OF PLANE SHOCK WAVES THROUGH A CHANNEL-DIAPHRAGM [DIFRAKTSIONNYYE YAVLENIYA PRI PROKHOZHDENII PLOSKIKH UDARNYKH VOLN CHEREZ KANAL-DIAFRAGMU]
A. V. Bondarenko and Makher Azis Ibragim Washington NASA Mar. 1969 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 5, 1968 p 174–179
(Contract NASw-1692)
(NASA-TT-F-12119) Avail: CFSTI CSCL 20D

The authors describe a determination of the flow pattern and a measurement of the velocities of different wave disturbances arising in a shock tube during the passage of shock waves through a short channel in an obstacle (diaphragm). In the region of unsteady flow immediately behind the obstacle, the complex diffraction pattern which is observed consists of the initial and secondary shock waves, the secondary contact discontinuity, and other interacting disturbances. Measurements show that the velocity of the initial disturbances changes periodically with time, undergoing damped oscillations at a distance of 16–17 cm from the obstacle. The formation of a new plane wavefront with a steady propagation velocity then occurs.
Author

N69-21198 Texas Univ., Austin.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE EXPANSION FLOW FIELD OVER A DELTA WING AT HYPERSONIC SPEEDS
Ernest James Cross, Jr. (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-10826

An experimental and analytical investigation was carried out to determine the character of the lee-side flow field over a slender delta wing with sharp leading edges in a hypersonic free stream. The experiments of the initial phase of a two part experimental program were for the purpose of obtaining qualitative data to identify the dominant features of the flow field. Schlieren, vapor screen and surface oil flow were useful experimental techniques in this application. The second phase of the experimental program was performed to supplement and extend the data acquired in the first phase. The surface pressure, surface temperature and impact pressure were measured at the points of an extensive array in the lee-side flow to determine the magnitude and extent of the flow phenomena.
Dissert. Abstr.

N69-21201# Boeing Co., Seattle, Wash. Flight Sciences Lab.
A NOTE ON THE DEVELOPMENT OF THE EKMAN LAYER AT A LEADING EDGE
John Olsen Jan. 1969 7 p refs
(D1-82-0791) Avail: Issuing Activity

The Schlichting governing equations for a barotropic three dimensional boundary layer are used for a flow over a flat plate with a leading edge. The boundary conditions for these equations were that the velocity must vanish at the plate surface and match the free stream velocity at the outer edge of the boundary layer. The equations were solved approximately through the use of the momentum integral method.
B.P.

N69-21207 Stanford Univ., Calif.
ON CLOSED STREAMLINE FLOWS
Frank Yu-Fang Pan (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-11334

The nature of fluid motions having closed streamlines, related heat transfer problems, and the problems of bubble deformation are discussed. The steady flow in a rectangular cavity are creeping flow solutions for cavities having aspect ratios from 1/4 to 5 were obtained numerically by a relaxation technique. Flow patterns were determined by means of photographic technique for finite cavities as well as for cavities of effectively infinite depth. The wake generated behind a backward facing step placed in a uniform stream was investigated experimentally in an oil tunnel. An asymptotic solution is developed for the temperature distribution at high Péclet number, in a doubly-connected, laminar, incompressible flow field consisting entirely of closed streamlines. The shape of a gas bubble or liquid drop moving steadily through an unbounded, quiescent, immiscible and viscous fluid medium is determined.
Dissert. Abstr.

N69-21229# Rensselaer Polytechnic Inst., Troy, N. Y.
TRANSIENT RESPONSE OF SUB-CAVITATING HYDROFOILS
Sunderam Krishnamurthy Jun. 1968 142 p refs
(PB-180938; TR-AE-6807) Avail: CFSTI CSCL 13J

The study investigates the transient response characteristics of fully wetted, hydroelastic systems characterized by low values of the mass-density-ratio parameter mu. The system transient

response characteristics are obtained within the framework of linearized, incompressible, potential theory. The first part of the study investigates hydroelastic systems that can be adequately described by the typical section. The second part of the study investigates systems that can be adequately described by the uniform, cantilever, pitch-plunge beam representation. Thus the additional parametric effects of sweep angle and aspect ratio may be included in the analysis of the hydrofoil characteristics.
Author (USGRDR)

N69-21265# Aeronautical Research Council (Gt. Brit.)
A NUMERICAL SOLUTION OF THE ANALYSIS AND DESIGN PROBLEMS FOR THE FLOW PAST ONE OR MORE AEROFOILS OR CASCADES. PART 1: THE ANALYSIS PROBLEM. PART 2: THE DESIGN PROBLEM
D. H. Wilkinson 1968 56 p refs Supersedes ARC-28941; ARC-29183
(ARC-R&M-3545; ARC-28941; ARC-29183) Copyright. Avail: HMSO, London: £1 4s

A numerical method is given for calculating the two-dimensional, inviscid, incompressible flow past one or more isolated aerofoils or cascades. This is an improved version of the surface vortex distribution methods of Martensen and of Jacob and Riegels. The numerical approximations of the earlier methods have been analysed and shown to result in ill-conditioned equations for sections with sharp trailing edges. The new method avoids this and, in conjunction with other improvements, gives almost exact results for sections with rounded or sharp trailing edges, for any thickness, down to less than 2 per cent chord, and any camber and pitch/chord ratio. Comparisons with other theories, and with experiment, for a wide range of cases demonstrate the accuracy of the method. Part II of this Report describes a new inverse method for the design of sections with given pressure distributions. This also deals with one or more aerofoils or cascades, and has the same accuracy and range of application as the analysis method of this report.
Author (ESRO)

N69-21307# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MATHEMATICAL THEORY OF THE BOLTZMANN EQUATION [THEORIE MATHEMATIQUE DE L'EQUATION DE BOLTZMANN]
Jean-Pierre Guiraud 1968 98 p refs In FRENCH; ENGLISH summary
(ONERA-NT-132) Avail: CFSTI

The existence and the unicity of the solutions of the linear Boltzmann equation are studied. The boundary problem examined corresponds to the movement of a gas enclosed in walls reflecting the molecules according to a very general but regular linear process, excluding in particular specular reflection. The domain of validity is that of small movements around the complete aerodynamic equilibrium. If Ω is the spatial domain, independent of time, within which the gas is contained, and if H is the Hilbert space the existence and unicity are established in the class $L^2(\Omega,H)$. This concerns the stationary movement as well as the non-stationary movement with given initial conditions.
Author

N69-21326# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aérothermique.
THE INSTABILITIES OF TWO-PHASE FLOW IN POROUS MEDIA OR BETWEEN TWO PLANAR PLATES [CONSIDERATIONS SUR LES INSTABILITES DIPHASIQUES EN MILIEU POREUX OU ENTRE DEUX PLAQUES PLANES]
Jean Bataille Apr. 1968 30 p refs In FRENCH
(REPT-68-1) Avail: CFSTI

The Darcy law is generalized and applied to unsteady Hele-Shaw flow and the modified stability criteria are derived. Capillary effects on steady axisymmetric flow are analysed and the linear stability conditions are discussed. A solution is given of time dependence of a front having an initially given form.
ESRO

N69-21334# Aeronautical Research Council (Gt. Brit.)
EXPERIMENTS ON INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS WITH DISTRIBUTED INJECTION
J. McQuaid 1968 58 p refs Supersedes ARC-28735
(ARC-R&M-3549; ARC-28735) Copyright. Avail: CFSTI

An extensive series of mean velocity measurements on the incompressible turbulent boundary layer with distributed injection is described. Boundary-layer developments have been measured along a porous flat plate under a variety of conditions, using 'Vyon' sintered polythene as the porous surface. The experiments included both zero and non-zero pressure gradients but were restricted to air-to-air injection without heat transfer. The boundary layer developments were measured with injection rates (v_0/U_1) between 0 and 0.008 at free stream velocities of 50 and 150 ft/sec while some additional velocity profiles at one station only with injection rates up to 0.0145 were also measured. In addition, an experiment on a boundary layer where the injection rate was suddenly reduced to very nearly zero has been carried out. Direct measurements have been made to determine whether any significant convergence or divergence of the tunnel flow or significant static pressure variations through the boundary layer were present. The question of the aerodynamic smoothness of the porous surface used is also discussed. All the results obtained are presented in tabular form.
Author (ESRO)

N69-21341# National Physical Lab., Teddington (England). Ship Div.
SOME CAVITATION EXPERIMENTS WITH DILUTE POLYMER SOLUTIONS
Christopher Brennen Nov. 1968 16 p refs
(NPL-SHIP-123) Avail: CFSTI

The observation and analysis of wave patterns on the surface of fully developed cavities behind a series of axisymmetric headforms in water tunnel has been extended to small headforms and Reynolds numbers. The effect of small quantities of polymer additive on a frequency instability is also discussed.
ESRO

N69-21342# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
BOUNDARY-LAYER FLOW OF A VISCOELASTIC FLUID
F. J. Lockett Jan. 1969 9 p refs
(NPL-Ma-73) Copyright. Avail: CFSTI

Equations governing flow in a laminar boundary layer are developed for two-dimensional motion of an incompressible third-order viscoelastic fluid. The theory, which is restricted to fluids which are only slightly viscoelastic, is obtained as a perturbation of the corresponding Prandtl theory for a Newtonian fluid with the same kinematic viscosity. Flow past a semi-infinite flat plate at zero angle of incidence is considered in detail. It is shown that the effects of viscoelasticity may be significant although detailed conclusions depend on the order of magnitude of the various viscoelastic parameters. A deficiency is uncovered in previous work on the same problem for a second-order fluid; this is connected with the order of field equations in viscoelastic analyses. A controversy appearing in the published literature is discussed in the light of the present theory.
Author (ESRO)

N69-21347# Office National d'Études et de Recherches Aerospatiales, Paris (France).
APPLICATION OF THE METHOD OF UNSTATIONARY CHARACTERISTICS TO THE NUMERICAL COMPUTATION OF A STEADY COMPRESSIBLE FLOW [APPLICATION DE LA METHODE DES CARACTERISTIQUES INSTATIONNAIRES AU CALCUL NUMERIQUE D'UN ECOULEMENT PERMANENT COMPRESSIBLE]
Pierre Carriere and Claude Capelier 1968 13 p refs In FRENCH; ENGLISH summary Presented at the Reunion of Groupe Mecanique des Fluides de l'AGARD sur l'Aerodynamique Transsonique, Paris, 18–20 Sep. 1968
(ONERA-TP-830) Avail: CFSTI

The two-dimensional flow around an airfoil is computed as an asymptotic limit to an unstationary flow. As initial data it is possible to use a known solution and modify as a continuous function of time the limiting conditions, or impose the desired limiting conditions to an arbitrary flow. The evolution of the flow can be determined by the method of characteristics. A change of coordinates, such that the current lines and their orthogonal trajectories are represented by lines parallel to the axes, simplify the relations of the characteristics as well as the organization of the numerical computation. Author

N69-21367# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
LAMINAR, TRANSITIONAL AND TURBULENT HEAT TRANSFER BEHIND A BACKWARD FACING STEP IN SUPERSONIC FLOW
J. Sendford (Ph.D. Thesis) Oct. 1968 68 p refs
(VKI-TN-38) Avail: CFSTI

Recovery temperature, heat transfer and base pressure measurements have been made on two dimensional models with backward facing steps at a Mach number of 1.91 On all models the step was located 120 mm (L) from the leading edge, and step heights (H) of 3, 5, and 7 mm were used. Heat transfer was measured using a constant heat flux technique, and unit Reynolds numbers varied in the range 1.4×10^6 to 2.9×10^6 per metre. Pure laminar and transitional-type separations were studied. A decrease in recovery temperature in the separation region was observed, with, for transitional flows, a marked peak in the reattachment zone followed by relatively low values. Heat transfer fell behind the step to about half its upstream value and then increased, reaching up to three times the flat plate value in transitional flows. No peaks in heat transfer were observed. Base pressure and features of the recovery temperature and heat transfer distribution were found to depend on the parameter $H/L\ Re_L$. A few tests were made on the 7 mm step model with an artificially induced turbulent boundary layer at separation. In this case there was no decrease in recovery temperature in the separation region, though a peak in the reattachment zone followed by low values was again observed. Peaks in heat transfer were obtained in the reattachment zone at unit Reynolds numbers of $2.3 \sqrt{\ } 10^6$ and $2.9\ 10^6$ per metre. Author (ESRO)

N69-21387# Technische Hochschule Munchen (West Germany).
TWO-PHASE FLOW OF METAL VAPORS INTO A VACUUM [ZWEIPHASENSTROEMUNGEN IN DAS VAKUUM MIT VERDAMPFUNG VON METALLEN]
Wolfgang Brunner (Ph.D. Thesis) 1968 118 p refs In GERMAN
Avail: CFSTI

Laboratory experiments were conducted to study the vaporization mechanism of metal clouds in the upper atmosphere. In these simulations, Ba–CuO mixtures with NaN_3 additions were burned in reaction vessels of 50 cm^3 volume. The reaction products passed through a convergent tungsten nozzle into a vacuum chamber of .20 m^3 volume with an initial 10^{-6} Torr. The attained reproducibility of combustion, ejection, and vaporization was such that reliable predictions were possible for vapor yield. In addition, the system permitted demonstration of the two-phase flow with vaporization in the nozzle and in free flow. Termination of the chemical reaction within the vessel was achieved after 5 to 10 ms. The resulting thermodynamic equilibrium was followed by evacuation, controlled by selecting a nozzle dimension which permitted termination of that process within approximately 200 ms. Measured were pressure in the reaction vessel, thrust of the reaction vessel, barium vapor density at a distance of 50 cm from the nozzle, vapor distribution vertical to the jet axis, mean aerosol velocity, and aerosol distribution. Transl. by K.W.

N69-21400*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
VISCOUS FLOW IN A SHORT CYLINDRICAL VORTEX CHAMBER WITH A FINITE SWIRL RATIO
Robert W. Hornbeck Washington Mar. 1969 34 p refs
(NASA-TN-D-5132) Avail: CFSTI CSCL 20D

The laminar incompressible viscous flow in a short cylindrical vortex chamber is analyzed numerically. The flow is assumed to enter the chamber periphery with an arbitrary ratio of tangential to radial velocity components and to exit at a line sink at the chamber axis. The numerical technique permits consideration of both the tangential and radial momentum equations. Comparisons are made with solutions available for the limiting cases of zero swirl and infinite swirl. Results are presented for a wide variety of swirl ratios, Reynolds numbers, and chamber aspect ratios. The results include radial and tangential velocity profiles, pressure distributions, and points of radial flow reversal. Author

N69-21466*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FLUID JET AMPLIFIER
W. S. Griffin, inventor (to NASA) Issued 7 Jan. 1969 (Filed 9 Jun. 1965) 5 p Cl. 137-81.5
(NASA-Case-XLE-03512; US-Patent-3,420,253; US-Patent-Appl-SN-462762) Avail: US Patent Office

Vent means are provided for the interaction region. Receiver outlets are connected to the interaction region through a receiver intermediate passageway and a receiver inlet passageway which are out of alignment with one another. A vent passageway which is in alignment with the receiver intermediate passageway is provided to receive reverse fluid flow from the receiver. Official Gazette of the U.S. Patent Office

N69-21507*# Lockheed Missile and Space Co., Sunnyvale, Calif.
SMALL AMPLITUDE LATERAL SLOSHING IN SPHEROIDAL CONTAINERS UNDER LOW GRAVITATIONAL CONDITIONS Final Report
P. Concus, G. E. Crane, and H. M. Satterlee 4 Feb. 1969 127 p refs
(Contract NAS3-9704)
(NASA-CR-72500; LMSC-A944673) Avail: CFSTI CSCL 20D

A finite difference technique utilizing an irregular-triangular mesh and the Wielandt inverse-iteration method is used to compute normal mode sloshing in spheroidal tanks of eccentricities ranging from zero to 0.8 under zero and low gravitational conditions for a contact angle of 5 degrees. The results are used to calculate, using a finite Fourier series expansion, liquid response to sinusoidal, square-wave, and periodic pulse lateral perturbing accelerations. Reduction of either liquid volume or gravity level increases the fundamental sloshing frequency. Author

N69-21519# California Univ., Berkeley. Div. of Aeronautical Sciences.

LINEAR HYDRODYNAMIC AND HYDROMAGNETIC STABILITY OF THE DISSIPATIVE, TWO-FLUID CYLINDRICAL COUETTE PROBLEM

Gary P. Schneyer (Ph.D. Thesis) Nov. 1968 134 p refs
(Contract Nonr-222(45))
(AD-681711; AS-68-12) Avail: CFSTI CSCL 20/9

The linear hydrodynamic and hydromagnetic stability of two incompressible, immiscible, dissipative fluids occupying separate annular regions of a cylindrical Couette apparatus is considered. The equations and boundary conditions governing this problem with arbitrary jumps in fluid properties and an applied axial magnetic field but without surface tension were derived; and computer programs written to solve them. Results are presented on the effect of density and viscosity jumps, varying gap widths, and differing fluid-fluid interfacial positions on the hydrodynamic stability of this problem. Evaluation of the linear hydromagnetic stability problem was postponed, as has the consideration of unstably stratified fluids. Two separate modes (multiple eigenvalues) were discovered for all cases in which two fluids, differing in any property, are present. A rationale is presented for this phenomenon as well as for most of the other observed results. While most of the observed results are attributed to manifestations of the Taylor Cylindrical Couette instability phenomenon, evidence is presented for the existence of additional hidden eigenvalues attributable to the classical Kelvin-Helmholtz and/or Yih viscosity jump instabilities.
Author (TAB)

N69-21525# Wisconsin Univ., Madison. Mathematics Research Lab.

CONSTRUCTION OF WEAK SOLUTIONS OF THE NAVIER–STOKES EQUATION IN A NON-CYLINDRICAL DOMAIN Technical Summary Report

Hiroshi Fujita and Niko Sauer Sep. 1968 10 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF-GP-8114)
(AD-681486; MRC-TSR-940) Avail: CFSTI CSCL 12/1

An existence theorem for time dependent solutions of the Navier-Stokes equation in regions bounded by moving boundaries is established by means of a new approximating procedure. This generalizes E. Hopfs result in 1951.
Author (TAB)

N69-21547*# New York Univ., N. Y. Dept. of Aeronautics and Astronautics.

CLASS OF EXACT SOLUTION OF RELATIVISTIC GAS

H. H. Chiu Jan. 1969 18 p refs
(Grant NGR-33-016-067)
(NASA-CR-100501; F-69-2) Avail: CFSTI CSCL 20D

A method of obtaining exact solutions for the relativistic gas mixtures at high effective temperatures, subjected to a body force or no body force, is presented. The method yields the solution of the conservation equation by linear superposition of the energy momentum tensor of the electromagnetic field with or without electric charge and current. The nature of the flow field of high temperature gas is similar to that of the photon gas within the first two approximations.
Author

N69-21548*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE ZERO DIFFUSIVITY INVARIANCE FOR CHEMICAL REACTION IN A TURBULENT FLUID

James C. Hill Mar. 1969 22 p refs
(NASA-TM-X-63498; X-641-69-108) Avail: CFSTI CSCL 20D

The distribution function approach is used for describing the turbulent chemical reaction in order to avoid violation of an invariance property noted by O'Brien: for zero molecular diffusion in homogeneous turbulence, single-point statistical functions of the concentration field are independent of the motion. This property and a similar white noise invariance for two point statistical functions are shown to apply to arbitrary isochoric motions when the initial concentration field is statistically homogeneous with respect to position. It was also observed that the use of a reciprocal concentration avoids the problem of preserving the invariance in turbulence closure schemes.
Author

N69-21550# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

GASEOUS PLUME DIFFUSION CHARACTERISTICS WITHIN MODEL PEG CANOPIES

R. N. Meroney, D. Kesic, and T. Yamada Sep. 1968 81 p refs
(Contract DAAB07-68-C-0423)
(AD-681938; CER68-69RNM-DK-TY-3; ECOM-C-0423-1) Avail: CFSTI CSCL 4/2

A point source of an air-helium mixture was released continuously at various positions within a simulated canopy composed of 9 cm high pegs, 0.48 cm diameter, spaced in several arrays (2.54 x 2.54, 3.55 x 3.55, and 5.08 x 5.08 cm). Variations of the vertical location of the source revealed the strongly nonisotropic character of diffusion within a canopy with respect to the relative diffusion rates in the lateral and vertical directions. When the source was placed at various downstream distances from the edge of the canopy, it displayed a tendency to exhale the plume near the front of the model canopy and to inhale the plume at distances further downstream. Calculations of the turbulent diffusion coefficient, K, within and above the canopy from the experimental data, reveal both a constant region and a region of linear increase with height increase as suggested by previous authors.
Author (TAB)

N69-21583# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FREE MOLECULAR FLOWING AROUND OF BODIES OF COMPLEX FORM

E. V. Alekseev and R. G. Barantsev Jun. 1968 18 p refs Transl. into ENGLISH from Aerodinomika Razreshennykh Gazov (USSR), no. 3, 1967 p 58–66
(AD-681641; FTD-MT-24-164-68) Avail: CFSTI CSCL 20/4

The free molecule flow over concave bodies is investigated using the moment method in kinetic theory. The relation between the incident molecular velocity distribution function and the boundary transform is given by a triple integral.
Author (TAB)

N69-21598# National Physical Lab. Teddington (England). Ship Div.

WAVE PATTERNS ON THE SURFACE OF HYDRODYNAMIC CAVITIES

C. Brennen Aug. 1968 26 p refs
(NPL-SHIP-121) Copyright. Avail: CFSTI

In experiments on cavities behind various axisymmetric headforms, a pattern of waves or ripples with crests parallel to the separation line was observed on the cavity surface just downstream of separation. A theoretical analysis suggests that this pattern results from amplified instabilities in the separated laminar boundary layer on the cavity surface.
Author (ESRO)

N69-21651# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Fluid Mechanics Section.

THE DENSITY FIELD ASSOCIATED WITH FREE-MOLECULAR EFFUSIVE FLOW FROM AN ANNULAR RING

J. Brook Mar. 1969 13 p refs
(RM-441J) Avail: CFSTI CSCL 12

The density field (gas clouds) associated with leaks and attitude control system plumes is a persistent problem in spacecraft experiments involving the detection of electromagnetic radiation. The operation of the control jets will normally be intermittent, so that the associated density field will be transitory in nature. For steady leaks, however, it becomes of interest to predict the level and distribution of the density field in order to estimate the degree of interference. The interference may take the form of simple absorption, elastic scattering of energy (usually sunlight) into the instrument field of view, or the emission of light after excitation by another source. The local contribution to the interference will be proportional to the local gas field density, and the complete interference will depend upon the appropriate integral along the instrument sight line. A major source of leaks is to be expected from the various hatches on the vehicle. Most accidental leaks can be treated as being free molecular, due to their low flow rate and small size. Author

N69-21663*# Nielsen Engineering and Research, Inc., Palo Alto, Calif.

CALCULATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS WITH PRESSURE GRADIENTS AND HEAT TRANSFER

Larry L. Lynes, Jack N. Nielsen, and Gary D. Kuhn Washington NASA Mar. 1969 141 p refs
(Contract NAS2-4391)
(NASA-CR-1303; NEAR-TR-6) Avail: CFSTI CSCL 20D

The method of integral relations has been applied to the calculation of compressible turbulent boundary layer characteristics under the action of pressure gradients. In order to solve the problem it was necessary to specify an eddy-viscosity model. A computer program was developed to do the calculations for a class of two dimensional or axisymmetric configurations from low speeds to hypersonic speeds. At hypersonic speeds, comparisons were made between predicted and measured boundary layer quantities for curved plates and flat plates with and without oblique shock wave impingement. The computer program has been applied to a hypersonic axisymmetric configuration composed of a hollow cylinder culminating in a compression flare. A simple method is presented for estimating the magnitude of the normal pressure gradients and of adjusting the displacement and momentum thicknesses predicted by boundary layer theory for the gradients. Author

N69-21721 British Hydromechanics Research Association, Harlow (England).

DATA ON THE CORRELATION OF PRESSURE LOSSES IN STRAIGHT NON-CIRCULAR PIPES FLOWING FULL

K. J. Zanker and G. M. Barratt Jan. 1969 34 p refs
(TN-909) Copyright. Avail: Issuing Activity: $12.00

With laminar flow, shape correction factors can be found theoretically and are verified experimentally, but with turbulent flow no sound theoretical approach exists. Three suggested methods of correlating turbulent flow data are considered, and their practical implications compared through examples. Possible ageing effects are discussed, but reliable trends are not established. Improved data can only result from more accurate experimental work. Author

N69-21722 British Hydromechanics Research Association, Harlow (England).

A REVIEW OF THE LITERATURE ON FLUID FLOW THROUGH CLOSED CONDUIT BENDS

K. J. Zanker and T. E. Brock Jul. 1967 39 p refs
(TN-901) Copyright. Avail: Issuing Activity: $12.00

Interest is biased towards head losses of bends associated with the cooling water systems of large (600 M. W. per set) power stations. Typically such bends are of circular arc, constant area construction with circular, square or rectangular cross sections of equivalent diameter $\simeq$ 10ft. carrying water at velocities $\simeq$ 10ft/sec. which corresponds to $R_e \simeq 10^7$. The bibliography contains over 200 references, it is no doubt incomplete. A great variety of bends appear in general civil engineering structures and these are not very well represented in the bibliography. Author

N69-21725 British Hydromechanics Research Association, Harlow (England).

A REVIEW OF LITERATURE ON THE DIVISION AND COMBINATION OF FLOW IN CLOSED CONDUITS

D. A. Crow and R. Wharton Jan. 1968 27 p refs
(TN-937) Copyright. Avail: Issuing Activity: $12.00

No attempt was made to correlate data, as the main purpose was to provide an introduction to future experimental work. The extreme complexity of the problem was emphasised and suggestions were made to standardise definitions and rationalise terminology. Author

N69-21739 British Hydromechanics Research Association, Harlow (England).

A REVIEW OF THE LITERATURE ON SUBSONIC FLUID FLOW THROUGH DIFFUSERS

David J. Cockrell (Leicester Univ., England) and A. L. King Nov. 1967 73 p refs
(TN-902) Copyright. Avail: Issuing Activity: $12.00

The present state of theoretical knowledge is clearly indicated, but the vast literature on boundary layers in adverse pressure gradients is not dwelt upon. Little is said about the class of diffuser whose shape makes it most suitable for application within the turbomachine, as radial diffusers, volutes and draft tubes are covered by their own specialist literature. The particular use of diffusers in venturimeters and fluidic devices are not considered. Emphasis is given to generalised experimental data and ways of improvement of otherwise poor performance. The review concludes with a recommended relevant research program. Author

N69-21740# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

INFLUENCE OF MACH NUMBER ON FLOW IN A THREE-DIMENSIONAL SEPARATION REGION

D. M. Voitenko et al Sep. 1968 11 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan. (Moscow), v. 23, no. 2, 1968 p 115–118
(Contract NOw-62-0604)
(AD-681781; APL-CLB-3-T-567) Avail: CFSTI CSCL 20/4

An experimental study was made of the flow structure in a three-dimensional separation region and of the effect of the free-stream Mach number on the flow pattern near a cylindrical obstacle. The model consisted of a flat plate with an infinitely high circular cylinder attached to it at 140 mm from the leading edge. The diameters of the test cylinders ranged from 3 to 30 mm; the Mach numbers varied from 1.75 to 3.85. The boundary layer before the separation line of the plate was turbulent. Results are given for interaction between the shock wave and the turbulent boundary layer and for the separated flow ahead of and behind the cylinder. Generalized relationships between the characteristic dimensions of the separation region, the external flow parameters, and the cylinder diameter are obtained. Author (TAB)

N69-21782# Joint Publications Research Service, Washington, D. C.
OBTAINING A POPULATION INVERSION OF MOLECULES IN A SUPERSONIC STREAM OF BINARY GAS IN A LAVAL NOZZLE
N. G. Basov et al 17 Mar. 1969 17 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Moscow), Dec. 1968 p 2031–2041 (JPRS-47655) Avail: CFSTI

Relaxation equations are derived for the vibrational degrees of freedom of the binary mixture nitrogen and carbon dioxide. The stationary problem of supersonic expansion of the mixture in a nozzle is solved. It is shown that under certain conditions the transition in carbon dioxide can be inverted. Optimum molar concentrations of carbon dioxide and stagnation parameters of the flow are determined. The efficiency of the population inversion is calculated. Author

N69-21887# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMICS OF RAREFIED GAS (CHAPTER 6)
M. N. Kogan Apr. 1968 108 p refs Transl. into ENGLISH from Dinam. Razrezhennogo Gaza (Kineticheskaya Teoriya) (Moscow), 1967 p 345–430
(AD-681611; FTD-MT-24-24-68) Avail: CFSTI CSCL 20/4

The article deals with free-molecular flows. In the first part the flowing around of convex bodies is discussed. Experiments are performed theoretically using a cylinder, sphere and flat plate to show stabilization of aerodynamic characteristics. In the next selection the flowing around of concave bodies is examined, which is followed by discussion of free-molecular flows in tubes. The measurement of pressure in free-molecular flow is dealt with as well as flows which are close to being free-molecular. In subsequent sections there is examined the following: molecular boundary layer, reciprocity theorem for flows close to being free-molecular, comparison of theoretical and experimental data on flows at large Knudsen numbers, and outflow into a vacuum. Author (TAB)

N69-21880# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EVALUATION OF THE EFFECT OF VORTICITY OF AN EXTERNAL FLOW ON FLOW PARAMETERS IN SEPARATION REGIONS
L. I. Vereshchagina-Myshkova Oct. 1968 13 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekh. i Astron. (Leningrad), no. 1, 1967 p 66–70
(Contract NOw-62-0604)
(AD-681779; APL-CLB-3-T-564) Avail: CFSTI CSCL 20/4

An analysis is given of the vortex interaction between the free-jet boundary layer and the external flow in the separation region of a hypersonic gas flow past a body. The parameter of the vortex interaction is determined by an analysis of an ideal flow coupled with the real flow in the separation region. The effect of variations in the vorticity level of the external flow on the structure of the mixing region is discussed. Author (TAB)

N69-21909# Pennsylvania State Univ., University Park. Systems and Controls Lab.
SYSTEMS AND CONTROLS LABORATORY RESEARCH REPORT
Apr. 1968 30 p refs
(RR-7) Avail: Issuing Activity

A study of thermal switching in fluidic elements is presented, including stall flow velocity profiles and computer analysis results for the parameters of the heated preferred wall boundary layers. Jet spreading in fluid amplifiers is examined, concentrating on the effect of high levels of upstream disturbance on velocity and turbulence profiles in the jet transition region. Experimental investigations of a fluid transmission line are compared to noncavitating flow models. Completion of the hydraulic pulsing system and diaphragm actuator for an hydraulic stepping motor is reported. An electrohydraulic adaptive control optimization system is discussed. Software development in the data management laboratory is summerized. Research concerning jet engine thrust modulation by vortex generation in the exhaust nozzle, fluid system response to FM signals, and fluid jet amplifier dynamics is described. The response of small cross-sectional area fluid transmission lines with loads along the length is analyzed. AND gate operation for curved wall jet studies and gate switching dynamics are discussed. Investigations relating to the effect of loads on the dynamic response of proportional fluid amplifiers are reported. P.A.B.

N69-21950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACOUSTIC EFFECT ON AERODYNAMIC CHARACTERISTICS OF A TURBULENT JET
E. V. Vlasov et al. Aug. 1968 20 p refs Transl. into ENGLISH from Iav. Akad. Nauk SSSR, Mekh. Zhidk. Gaze (Moscow), no. 4, 1967 p 133–138
(AD-681676; FTD-MT-24-232-68) Avail: CFSTI CSCL 20/4

An experimental study was made of the effect of sound of various intensities and frequencies on the mean and pulsating flow characteristics of a submerged turbulent jet. It was shown that at a certain sound intensity and frequency it is possible either to intensify or attenuate turbulent mixing. In general, a low frequency sound increased the mixing process. An attenuation of the turbulent mixing process was noted in the presence of a high frequency sound and relatively low Reynolds numbers. TAB

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-20734 Colorado Univ., Boulder.
A NEW TYPE OF ELECTRON DENSITY IRREGULARITY IN THE EQUATORIAL ELECTROJET: OBSERVATIONS AND INTERPRETATION
Ben Burton Balsley (Ph.D. Thesis) 1967 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-10603

VHF radar echoes from electron density irregularities in the equatorial electrojet indicate that there are two distinct types of irregularities present within the region. One of these has been shown to be generated by the well known two-stream instability. These two-stream irregularities are planar structures which travel at the sonic velocity. The other irregularities are somewhat weaker and drift with the approximate velocity of the electrons. Drift observations of this second type of irregularity show that the electrojet current is reversed during nighttime periods, with reversal times at about 0645 hours and 2030 hours local time. The proposed generation mechanism for this second type of irregularity is the larger shear in electron velocity near the bottom and top of the region. Although the physical properties of the flowing electron gas are much more complex than those of neutral gas flow, the characteristics obtained for these irregularities are consistent with the idea that they are generated by a form of plasma turbulence. Dissert. Abstr.

N69-20757 Colorado Univ., Boulder.
IONOSPHERIC DISTURBANCES DUE TO ATMOSPHERIC WAVES
Thomas Martin Georges (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-12404

The theoretical and experimental evidence is investigated that disturbances in the neutral atmosphere cause ionospheric traveling irregularities that affect radio propagation. Traveling disturbances are found to be divided into two distinct classes which we call "very large" and "medium scale." The very large disturbances are closely associated with magnetic storm activity, while the medium-scale disturbances are not, but still come from the polar regions. Both types are manifestations of internal atmospheric gravity waves. A new technique is presented for monitoring the essential properties of traveling disturbances on a routine basis. It utilizes a network of steep-incidence CW Doppler sounders in a multifrequency, spaced-transmitter configuration.
Dissert. Abstr.

N69-20761 Arizona Univ., Tucson.
MAGNETIC PROPERTIES OF ROCKS ASSOCIATED WITH THE NEW CORNELIA PORPHYRY COPPER DEPOSIT, PIMA COUNTY, ARIZONA
Bruce Tipton May (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-11929

Four hundred eighty four oriented cores were taken at 47 sites in 7 geologic formations closely connected with the porphyry copper deposit at Ajo, Arizona, in an attempt to determine the extent to which rock magnetism can add to geologic knowledge of the area. A spinner magnetometer having an operating sensitivity of 10^{-9} emu/cc was constructed for the project, and from the output data of this magnetometer a dispersion parameter was developed which proved to be a new, useful property of the remanence. Remanence and its thermal demagnetization play major roles in the interpretation of the magnetic data, and susceptibility and saturation magnetization are subsidiary but necessary properties used in interpretation.
Dissert. Abstr.

N69-20768 Washington Univ., Seattle.
PALEOMAGNETISM OF PLIO–PLEISTOCENE VOLCANIC ROCKS FROM SOUTH KOREA AND STUDIES OF THE EARTH'S ANCIENT MAGNETIC FIELD
John Kenneth Kienzle (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-10782

Long term variations of the Earth's magnetic field (greater than 300 years) can only be studied by paleomagnetic methods. Insufficient data are available to make a detailed analysis of these variations; however, general features of the ancient field can be determined. Most paleomagnetic investigations have been primarily concerned with the direction of the ancient field, but it is also possible to obtain data that represent the intensity and secular variation of the ancient field. This thesis describes the use of paleomagnetism to obtain accurate intensity values of the Earth's ancient magnetic field and to make estimates of the secular variation of the field during the past 3 million years. Some problems concerning the general nature of the Earth's ancient magnetic field are also considered using paleomagnetic data obtained from South Korea as well as worldwide data from other investigators.
Dissen. Abstr.

N69-20895 Minnesota Univ., Minneapolis.
STRATOSPHERIC DUST
James Martin Rosen (Ph.D. Thesis) 1967 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-7377

Simultaneous soundings of ozone and sub-micron dust over North and Central America are reported. The results show considerably more dust in the equatorial stratosphere than in the middle latitude stratosphere. The relative maximum in the dust concentration observed near the level of the tropical tropopause and as far north as 60° is attributed to an equatorial dust source. The occasional appearance of a secondary dust maximum immediately above the mid-latitude tropopause is attributed to a form of transport other than that of eddy diffusion. The structure in the ozone and dust profiles appears to be highly correlated in the lower mid-latitude stratosphere. A quantitative model is presented describing the production and transport of dust in the stratosphere.
Dissert. Abstr.

N69-20911# Joint Publications Research Service, Washington, D. C.
THE STRUCTURE OF THE TEMPERATURE FIELD AT THE OCEAN SURFACE
V. N. Ivanov et al 12 Mar. 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, v. 183, no. 6, 1968 p 1304–1307 (JPRS-47621) Avail: CFSTI

Floating electrothermographic data from continuous recordings of oceanic water surface temperatures are evaluated statistically. Temperature variability curves for individual regions of the oceans are treated as auxiliary hydrological characteristics. Large scale nonhomogeneities are observed in coastal regions; medium scale nonhomogeneities in open sea currents are attributed to wave agitation in the presence of intensive radiant heat influx. G.G.

N69-20952 California Univ., San Diego.
GEOMAGNETIC SECULAR VARIATION AND THE KINEMATICS OF THE EARTH'S CORE
John Ratcliffe Booker (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-11109

If the core field is modeled by extrapolating the imprecisely known field at the earth's surface, small scale errors destroy its validity. This problem is removed by smoothing the field with a filter which weights each degree in its spherical harmonic expansion. There is apparently no advantage to any filter other than the one which simply truncates the expansion. Mantle absorption is also discussed in some detail. Attenuation curves are computed for spherical harmonic degrees up to ten, and on the basis of scale periods computed from the data, discount this effect. It was concluded that GSFC-(12/66) is the best current estimate for the spherical harmonic coefficients of both the field and its time derivative. The maximum coefficient errors are probably less than 9 gamma for the main field and .5 to 1 gamma/year for the time derivatives; the main and time derivative fields are unreliable above degrees eight and six respectively.
Dissert. Abstr.

N69-20954 Wisconsin Univ., Madison.
AN INVESTIGATION INTO VELOCITY ANISOTROPY THROUGH MEASUREMENTS OF ULTRASONIC WAVE VELOCITIES IN SNOW AND ICE CORES FROM GREENLAND AND ANTARCTICA
Hugh Frederick Bennett (Ph.D. Thesis) 1968 314 p
Avail: Univ. Microfilms: HC $14.20/Microfilm $4.05 Order No. 68-9055

Detailed ultrasonic velocity measurements were made on snow and ice cores from Greenland and Antarctica for the purpose of studying velocity anisotropy and its relationship to the petrofabric

analyses of these cores. In addition, ultrasonic velocities were measured in the near surface snow layers at Byrd Station and South Pole Station, Antarctica. This was done to provide a detailed velocity profile in the region of the ice sheet where the velocity is greatly influenced by the snow structure. A discussion of the experimental arrangement and background theory is presented. Subjects covered concerning the experimental arrangement include the design of equipment, measurement errors, techniques, and problems encountered in the study. The theory of wave propagation in a general anisotropic medium is reviewed and a detailed presentation of this theory, as concerns transversely isotropic media, is given. A method is developed whereby a theoretical velocity model can be calculated from the petrofabric analyses on the ice cores and thus provides a means of testing the theory with field and laboratory observations. Dissert. Abstr.

N69-20978# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).

OPTIMAL REPRESENTATION OF THE GEOMAGNETIC POTENTIAL IN AN OFF-CENTERED, INCLINED DIPOLE SYSTEM OF COORDINATES [REPRESENTATION OPTIMALE DU POTENTIEL GEOMAGNETIQUE DANS LE REPERE D'UN DIPOLE DECENTRE, INCLINE]

J. Bernard, J. C. Kosik, G. Laval, R. Pellat, and J. P. Philippon Dec. 1968 20 p refs In FRENCH; ENGLISH summary

(CERTS-NT-01-19) Avail: CFSTI

The transformation formulas of the harmonic coefficients of the geomagnetic potential for a rotation and a translation of the frame of reference are devised. Author (ESRO)

N69-20995# National Research Council of Canada, Ottawa (Ontario). Space Research Facilities Branch.

BIBLIOGRAPHY: SCIENTIFIC PAPERS RESULTING FROM THE CANADIAN UPPER ATMOSPHERE RESEARCH PROGRAM, 1965–1968

William H. Waters Feb. 1969 21 p refs

(PD-6491; SRFB-025) Avail: CFSTI

An annotated bibliography of upper atmospheric research is presented in chronological order. Also included is a list of reports published by the photographs Research Facilities Branch. F.O.S.

N69-21023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IONOSPHERIC AND MAGNETIC OBSERVATIONS AT 1000 KILOMETERS DURING THE GEOMAGNETIC STORM AND AURORA OF 25–26, MAY 1967

J. A. Findlay, P. L. Dyson, L. H. Brace, A. L. Zmuda, and W. E. Radford Feb. 1969 25 p refs

(NASA-TM-X-63491; X-621-69-64) Avail: CFSTI CSCL 04A

Measurements of electron temperature and density and of transverse magnetic disturbances obtained at 1000 kilometers before, during and after the magnetic storm and aurora of May 25–26, 1967 are compared with visual observations of the aurora and a degree of correlation is apparent. Throughout the latitudinal region of visual aurora the electron temperature and its latitudinal variations were much greater than are observed under quiet conditions. Temperatures in excess of 6500°K and temperature variations of greater than 500°K within less than 4 km along the satellite path were measured. Temperatures this high suggest a heat source other than auroral electron bombardment. The electron density was also extremely structured through the region of visual aurora. Horizontal gradients were observed in which the density changed by greater than 50% in less than 100 meters along the satellite path. The greatest density measured was $\sim 6.5 \times 10^4$/cc (at $\lambda = 53°$). The magnetometer recorded a number of disturbances (as large as 308γ) in the region of unusual density and temperature behavior. Author

N69-21041# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

VERTICAL VELOCITIES IN CLEAR-AIR TURBULENCE

Robert R. Long May 1968 21 p

(D1-82-0738) Avail: CFSTI

Observational and theoretical considerations of gravitational stable density variations in clear air turbulence of the atmosphere are reviewed. Aircraft photographs of clear air turbulence in mountainous areas suggest the breaking of gravity waves in airflow over mountains with subsequent growth of instability and turbulence by vertical shears and by overturning instabilities as the wave amplitude gets so large that the local density variation with height reverses, giving potential heavy air over lighter air. Clear air turbulence in non-mountainous areas is associated with layers in which the Richardson number is of order one or greater. G.G.

N69-21190# Commission on Marine Sciences, Engineering and Resources, Washington, D. C.

THE PREPARATION OF ARTICLE 1 OF THE CONVENTION ON THE CONTINENTAL SHELF

Bernard H. Oxman [1969] 203 p refs

(PB-182100) Avail: CFSTI CSCL 05D

The purpose of the study is to examine the background of Article 1 of the Convention on the Continental Shelf as revealed by the official records of the International Law Commission, which spent six years preparing draft articles on the Law of the Sea, and the 1958 United Nations Conference on the Law of the Sea, which adopted the Convention on the Continental Shelf after some modifications of the Commission's draft articles regarding the continental shelf. Article 1 of the Convention is the only article which identifies the area, including the seaward extent, of the seabed and subsoil over which coastal states enjoy sovereign rights for the purpose of exploration and exploitation of natural resources. Thus it affects not only the seaward limit of the seabed area subject to the jurisdiction over natural resources of the nearest coastal state but also the landward limit of the seabed area beyond the limits of national jurisdiction whose legal status is attracting considerable international attention. USGRDR

N69-21236# Chicago Univ., Ill. Lab. for Atmospheric Probing.

LABORATORY FOR ATMOSPHERIC PROBING Technical Reports

1 Feb. 1969 83 p refs Prepared in cooperation with IIT Res. Inst.

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CONTENTS:

1. DOPPLER CROSSWIND RELATIONS IN RADIO TROPO-SCATTER BEAM SWINGING FOR A THIN SCATTER LAYER D. H. Sargeant (Wisc. Univ.), D. Atlas, R. C. Srivastava, and R. E. Carbone 42 p refs (See N69-21237 10-13)

2. THE INFLUENCE OF SPECULAR REFLECTIONS ON BISTATIC TROPOSPHERIC RADIO SCATTER FROM TURBULENT STRATA D. Atlas, R. C. Srivastava, and W. S. Marker, Jr. 13 p refs (See N69-21238 10-13)

3. THE MEASUREMENT OF CROSSWIND BY NON-COHERENT DUAL ARM BISTATIC RADIO TROPOSCATTER TECHNIQUES D. Atlas 17 p refs (See N69-21239 10-13)

N69-21237# Chicago Univ., Ill. Lab. for Atmospheric Probing.

DOPPLER CROSSWIND RELATIONS IN RADIO TROPO-SCATTER BEAM SWINGING FOR A THIN SCATTER LAYER

David Atlas, R. C. Srivastava, R. E. Carbone, and D. H. Sargeant (Wisc. Univ., Madison) *In its* Lab. for Atmospheric Probing 1 Feb. 1969 42 p refs Prepared in cooperation with IIT Res. Inst. (See N69-21236 10-13)
(TR-8) Avail: Issuing Activity

This paper examines the form of the Doppler spectrum of the signals scattered by a thin, horizontally homogeneous, refractively turbulent layer via a bistatic radio link. Relations are developed between the mode of the Doppler spectrum, $\hat{f}$, and the beam offset angle or distance from the great circle at mid-path, Y, as a function of the height of the scatter layer, the crosswind speed at that height, and the form of the refractivity spectrum. With real beams, the spectrum is weighted by the high reflectivity scatters on the great circle side of the beam axis. $|\hat{f}|$ is always less than that of the scatterers at $|Y|$, and the relation is non-linear. At sufficiently large beam offsets, however, the $|\hat{f}|-|Y|$ curve again becomes linear with slope slightly greater than expected for "zero" beamwidth; moreover, the slope becomes insensitive to either the height of the layer or the form of the refractivity spectrum. Accordingly, the crosswind speed can be estimated within a few per cent. The $|\hat{f}|-|Y|$ data may then be processed to provide an estimate of the layer height, the form of the refractivity spectrum, and the dependence of the layer reflectivity on distance from the great circle. Author

N69-21238# Chicago Univ., Ill. Lab. for Atmospheric Probing.
THE INFLUENCE OF SPECULAR REFLECTIONS ON BISTATIC TROPOSPHERIC RADIO SCATTER FROM TURBULENT STRATA
David Atlas, R. C. Srivastava, and W. S. Marker, Jr. *In its* Lab. for Atmospheric Probing 1 Feb. 1969 42 p refs Prepared in cooperation with IIT Res. Inst. (See N69-21236 10-13)
(TR-9) Avail: Issuing Activity

Specular reflection from a stratum of sharp mean vertical refractivity gradient frequently accompanies the scatter from the turbulent perturbations in refractivity which tend to be maximized close to the gradient. As a result, the signal intensity falls more rapidly with beam offset angle from the great circle than is the case for pure turbulent scatter. Also, in transmission via the great circle path, the Doppler spread, signal fading rate, and multi-path spread may be greatly reduced from that expected for turbulent scatter alone. Because transmission along the great circle may be greatly influenced by specular reflections, the strength of which is a function of the form and sharpness of the mean refractivity gradient, past experiments relating signal-wavelength dependence or signal-scatter angle dependence to the form of the turbulent refractivity spectrum are suspect. Author

N69-21239# Chicago Univ., Ill. Lab. for Atmospheric Probing.
THE MEASUREMENT OF CROSSWIND BY NON-COHERENT DUAL ARM BISTATIC RADIO TROPO-SCATTER TECHNIQUES
David Atlas *In its* Lab. for Atmospheric Probing 1 Feb. 1969 17 p refs Prepared in cooperation with IIT Res. Inst. (See N69-21236 10-13)
(TR-10) Avail: Issuing Activity

The use of a dual-arm non-coherent bistatic tropo-scatter link is proposed as a means of measuring the cross-path motion of the wind. The arms are skewed symmetrically to either side of the great circle path so that one is pointing upwind and the other downwind. The signals received on each arm are then associated with Doppler frequency shifts of opposite sign. When summed at the receiver, their beating produces a signal fluctuation spectrum having a secondary peak equal to the difference in the mean Doppler frequencies on the two arms. This is directly proportional to the crosswind. Another approach involves the measurement of the mean-square signal fluctuation rate or spectrum variance on each arm of the link separately and then with both arms combined. The latter is the power-weighted sum of the variances on the individual arms plus a term which is proportional to the difference of the mean Doppler frequencies between the two arms of the link, and thus to the speed of the crosswind. Author

N69-21244# National Research Council of Canada, Ottawa (Ontario).
SPACE AND UPPER ATMOSPHERE RESEARCH IN CANADA. BALLOONS, ROCKETS AND SATELLITES
Jan. 1969 46 p
(SRFB-024) Avail: CFSTI

Canada's activities in space, and her contribution to the international effort are summarized. While not too well known, these activities are carried on through the media of balloon lifted instrumentation, sounding rockets, satellites, and ground based research laboratories. Balloons were first employed in upper atmospheric research early in this century, and ground based research was used in the studies of the aurora borealis as early as 1867. The use of sounding rockets as a tool for upper atmospheric research in Canada commenced in 1957. Satellite research was started in 1958 during the planning stage of Alouette 1. Space and upper atmosphere research covers a broad range of scientific disciplines in the fields of basic and applied research. Programs are conducted by various government departments and universities. Author

N69-21261 Colorado Univ., Boulder.
RESONANT-MODE COUPLING EFFECTS IN THE EARTH-IONOSPHERE CAVITY
David Brownlee Large (Ph.D. Thesis) 1968 214 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-12414

The research reported here involves the analytical study of mode coupling effects. Various mathematical cavity models are analyzed. Two different models are used to analyze the mode coupling effects due to a dipolar, static magnetic field configuration, and the influence of transverse electric modes is clearly illustrated. Another model is used to examine the coupling of modes of like species due to an abrupt transition between day and night ionospheric boundaries. Finally, a model with both day and night hemispheres and a dipolar static magnetic field is analyzed, and the predicted resonant characteristics are compared with a constant field model whose field strength is equal to the average of the radial component of the dipolar field model. Finally, the phenomenon of changing resonant mode frequency with source-receiver spacing is illustrated, and previously measured diurnal changes in the resonances are explained qualitatively. Dissert. Abstr.

N69-21267# Joint Publications Research Service, Washington D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, No. 199
28 Feb. 1969 156 p refs Transl. into ENGLISH from Russian Articles
(JPRS-47552) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–7 refs (See N69-21268 10-30)
2. METEOROLOGY p 8–69 refs (See N69-21269 10-20)
3. OCEANOGRAPHY p 70–85 refs (See N69-21270 10-13)

4. TERRESTRIAL GEOPHYSICS p 86–105 refs (See N69-21271 10-13)

5. UPPER ATMOSPHERE AND SPACE RESEARCH p 106–140 refs (See N69-21272 10-13)

N69-21270# Joint Publications Research Service, Washington, D. C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 199 28 Feb. 1969 p 70–85 refs (See N69-21267 10-13)
Avail: CFSTI

News items are reported concerning the status of various voyages of Soviet expeditionary vessels. Antarctic research, oceanic radioactivity studies, devices for measuring luminophor concentration and salinity in sea water, turbulent diffusion investigating sensors, and oceanographic facilities, observation planning, and graphic information plotting. Abstracts of recent Soviet publications are presented in following areas, along with complete bibliographic information: marine acoustics problems, marine optics research, electrical contact wave recorder development, statistical analysis applications, temperature field structure investigations in surface ocean layers, and studies on circulation characteristics around ocean islands, the wind velocity field in a layer over water, sea swells and air turbulence, and the light haze structure formed by a radiation beam in water. P.A.B.

N69-21271# Joint Publications Research Service, Washington, D. C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 199 28 Feb. 1969 p 86–105 refs (See N69-21267 10-13)
Avail: CFSTI

Brief news items are reported on a conference on tsunamis, seismology and logic studies, a method of analytical phototriangulation, and construction of a new seismic station. Abstracts of recent Soviet publications are presented, along with complete bibliographic information. Seismic oscillation recording, wave arrival identification, and spectral calibration; measurements of crustal deformation by tiltmeters and of stresses and strains in the ground; earthquake prediction methods; velocity distribution determination and body wave curves; neutron spectrometry usage; and Love wave computation are some of the areas covered. P.A.B.

N69-21272# Joint Publications Research Service, Washington, D. C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 199 28 Feb. 1969 p 106–140 refs (See N69-21267 10-13)
Avail: CFSTI

News items are reported, including orbital data on Kosmos 263 and 264; flight, cosmonaut, and landing data on Soyuz 4 and 5; and Soviet Venus probe information. Abstracts of recent publications are presented, along with complete bibliographies. Geophysical research at Vostok, Antarctica, including polar cap absorption findings; flight trajectory computation for fly-by missions; magnetospheric longitudinal current investigations; correlations between meteorological parameters and the solar wind; and studies on photoion production and ionization inhomogeneities in the F-layer are among the areas covered. P.A.B.

N69-21323# Institut Royal Météorologique de Belgique, Brussels.
AEROLOGICAL OBSERVATIONS, UCCLE STATION BELGIUM. FIVE-YEAR STATISTICS, 1951–1955 [OBSERVATIONS AEROLOGIQUES, STATION D'UCCLE, BELGIQUE: STATISTIQUES QUINQUENNALES, 1951-1955]
1968 73 p In FRENCH and DUTCH
Avail: CFSTI

The pressure, temperature and humidity data obtained with radiosondes launched, twice daily, at Uccle, Belgium, during the period 1951-1955 are treated statistically. ESRO

N69-21327# Institut Royal Météorologique de Belgique, Brussels.
IONOSPHERIC OBSERVATIONS [OBSERVATIONS IONOSPHERIQUES] Monthly Bulletin, Oct. 1968
1968 25 p In FRENCH and FLEMISH
Avail: CSFTI

Ionospheric data are given from Belgian observatories during October 1968. (ESRO)

N69-21328# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, Oct. 1968
1968 15 p In FRENCH and FLEMISH
Avail: CFSTI

Data are given on the atmospheric conditions in Belgium during October 1968. ESRO

N69-21329# Institut Royal Météorologique de Belgique, Brussels.
IONOSPHERIC OBSERVATIONS [OBSERVATIONS IONOSPHERIQUES] Monthly Bulletin, Nov. 1968.
1968 25 p In FRENCH and FLEMISH
Avail: CFSTI

Ionospheric data derived from observations in November 1968 at Dourbes (Belgium) are presented. ESRO

N69-21332 Institut Royal Météorologique de Belgique, Brussels.
IONOSPHERIC OBSERVATIONS [OBSERVATIONS IONOSPHERIQUES] Monthly Bulletin, Sep. 1968
1968 25 p In FRENCH and FLEMISH
Avail: CFSTI

Ionospheric data are given from Belgian observatories during September 1968. ESRO

N69-21360# Woods Hole Oceanographic Institution, Mass.
BIBLIOGRAPHY OF TECHNICAL REPORTS, 1968
Cecelia B. Fuglister, comp. Jan. 1969 20 p refs
(Ref-68-82) Avail: Issuing Activity

Bibliography on oceanographic subjects of geology, hydrology, marine life and biology, current measurements and organic chemistry for 1968. J.A.M.

N69-21406# Kakioka Magnetic Observatory (Japan).
GEOMAGNETIC OBSERVATIONS AT KANOYA JAPAN IN 1963
1968 120 p refs
(Rept-55) Avail: CFSTI

The results of geomagnetic observations carried out by the Kakioka Magnetic Observatory are presented. Hourly values and associated mean values of magnetic elements are given in tabular form, including declination, horizontal intensity, and vertical intensity data. Reproductions of magnetograms for 1963 are supplied. P.A.B.

N69-21409*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A THEORY OF THERMOSPHERIC DYNAMICS. PART 2: GEOMAGNETIC ACTIVITY EFFECT, 27 DAY VARIATION AND SEMIANNUAL VARIATION

H. Volland Feb. 1969 35 p refs

(NASA-TM-X-63496; X-621-69-42) Avail: CFSTI CSCL 08N

They are treated by a one dimensional model in order to find out the height distribution and the amount of energy necessary to create the observed amplitudes and phases of the neutral density between 120 and 400 km altitude. Three types of heat energy sources were considered which simulate energy input: bottom of the thermosphere; within the thermosphere; and top of the thermosphere. The geomagnetic activity effect and the 27 day variation can be described as generated by heat source within the thermosphere which is interpreted as resulting from corpuscular radiation into the aurora zones and from solar active region EUV radiation, respectively. The semiannual effect can be described by heat source at the bottom of the thermosphere and is interpreted as resulting from dissipated energy of a tidal wave from the lower atmosphere. The leakage of the energy of this tidal wave into the thermosphere shows a semiannual variation which creates the observed density variations. Quantitative calculations give the amount of energy of the various heat sources, amplitudes and phases of the generated density and temperature variations and their dependence on solar activity. Author

N69-21433# Israel Program for Scientific Translations, Ltd., Jerusalem.

MECHANICAL PROPERTIES OF ROCKS

M. M. Protodyakonov et al 1968 184 p refs Transl. into ENGLISH of the book "Mekhanicheskie Svoistva Gornykh Porod" Moscow, AN SSSR, 1963 p 1–184

(TT-68-50377) Copyright. Avail: CFSTI

CONTENTS:

1. METHOD OF DETERMINING THE STRENGTH OF ROCKS UNDER UNIAXIAL COMPRESSION M. M. Protodyakonov p 1–8 (See N69-21434 10-13)

2. PROPHILOGRAPHIC INVESTIGATIONS AND CORRECT DATA ON MECHANICAL PROPERTIES OF ROCKS M. I. Koifman et al p 9–14 refs (See N69-21435 10-13)

3. METHODS OF DETERMINING THE SHEARING STRENGTH OF ROCKS M. M. Protodyakonov p 15–27 refs (See N69-21436 10-13)

4. EFFECT OF ROCK-SPECIMEN SIZE ON MECHANICAL PROPERTIES IN SHEAR TESTS E. I. Ilnitskaya p 28–33 refs (See N69-21437 10-13)

5. METHODS OF INVESTIGATING THE MECHANICAL PROPERTIES OF ROCKS UNDER TRIAXIAL (VOLUMETRIC) STRESS M. M. Protodyakonov et al p 34–56 refs (See N69-21438 10-13)

6. RECORD GRAPHS OR "CERTIFICATES" OF COAL STRENGTH E. I. Ilnitskaya p 57–63 refs (See N69-21439 10-13)

7. DETERMINATION OF STRENGTH AND ELASTIC PROPERTIES OF COUNTRY ROCK AND COAL OF THE LENINSK–KUZNETSK BITUMINOUS-COAL DEPOSITS OF THE KUZNETSK BASIN (KUZBASS) G. I. Yagodkin et al p 64–73 refs (See N69-21440 10-13)

8. QUICK COMBINED METHOD OF DETERMINING MECHANICAL PROPERTIES OF ROCKS M. I. Koifman p 74–86 refs (See N69-21441 10-13)

9. NEW METHOD OF INVESTIGATING THE STRENGTH PROPERTIES OF TYPICAL ROCKS IN SOME COAL AND SHALE DEPOSITS M. I. Koifman et al p 87–96 refs (See N69-21442 10-13)

10. INDIRECT METHODS OF DETERMINING THE TENSILE STRENGTH OF ROCKS A. P. Stepanov p 97–100 (See N69-21443 10-13)

11. ELEMENTARY FRACTURE AND MINERALOGICAL AND PETROGRAPHICAL PECULIARITIES OF ROCKS M. I. Koifman et al p 101–108 refs (See N69-21444 10-13)

12. THE SIZE FACTOR IN ROCK PRESSURE INVESTIGATIONS M. I. Koifman p 109–117 refs (See N69-21445 10-13)

13. INVESTIGATIONS OF THE EFFECT OF SPECIMEN DIMENSIONS AND ANISOTROPY ON THE STRENGTH OF SOME COALS IN THE DONETS AND KUZNETSK BASINS M. I. Koifman et al p 118–129 refs (See N69-21446 10-13)

14. INVESTIGATION OF THE SIZE FACTOR IN THE STRENGTH OF ROCKS AS RELATED TO THEIR PETROGRAPHIC STRUCTURE M. I. Koifman et al p 130–137 refs (See N69-21447 10-13)

15. CONTACT CHANGES IN TESTED AND DISRUPTED ROCKS M. I. Koifman p 138–149 refs (See N69-21448 10-13)

16. DETERMINATION OF BRITTLENESS AND PLASTICITY OF ROCKS BY REPEATED INDENTATION M. I. Koifman et al p 150–158 refs (See N69-21449 10-13)

17. DETERMINATION OF ROCK HARDNESS, AS RELATED TO COMPONENT MINERALS, BY THE IMPACT-AND-REBOUND METHOD P. V. Vasilev p 159–163 (See N69-21450 10-13)

18. MECHANICAL PROPERTIES AND DRILLABILITY OF ROCKS M. M. Protodyakonov p 164–176 refs (See N69-21451 10-13)

N69-21434# Israel Program for Scientific Translations, Ltd., Jerusalem.

METHOD OF DETERMINING THE STRENGTH OF ROCKS UNDER UNIAXIAL COMPRESSION

M. M. Protodyakonov *In its* Mech. Properties of Rocks 1968 p 1–8 (See N69-21433 10-13)

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The main recommendations of proposals for the establishment of an international standard are summarized. The accepted proposal is outlined as to its purpose: to determine the ultimate compression strength of natural rocks, so as to be able to forecast their behavior in underground workings; sampling techniques; number of specimens to be tested; size and shape of the specimens; preparation of specimens; testing equipment and procedure; and calculations. B.P.

N69-21435# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROPHILOGRAPHIC INVESTIGATIONS AND CORRECT DATA ON MECHANICAL PROPERTIES OF ROCKS

M. I. Koifman et al *In its* Mech. Properties of Rocks 1968 p 9–14 refs (See N69-21433 10-13)

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Micrographs of surface irregularities in rock specimens were analyzed. The distortions, caused by machining methods, grain size, hardness, and porosity, affected laboratory test results on rock strength. In order to obtain correct data on the real strength of rocks, it was suggested that the accuracy standards for the finish of contact surfaces be raised. Recommendations for the preparation of rock specimens included replacing hand finishing by machine finishing; using diamond tools for boring and cutting rocks, and fine abrasives for lapping the working faces of specimens; and machining simultaneously a large number of specimens. B.P.

N69-21436# Israel Program for Scientific Translations, Ltd. Jerusalem.
METHODS OF DETERMINING THE SHEARING STRENGTH OF ROCKS
M. M. Protodyakonov *In its* Mech. Properties of Rocks 1968 p 15–27 refs (See N69-21433 10-13)
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Torsion, pure shear, shear with compression, and sliding methods are reviewed for determining the shear resistance o rocks. The shearing strength of rocks compressed in beveled die was examined in detail. A standard was proposed for determining the ultimate shearing strength of rocks to permit comparisons and behavior forecasting in mine development work. B.P

N69-21437# Israel Program for Scientific Transactions, Ltd., Jerusalem.
EFFECT OF ROCK-SPECIMEN SIZE ON MECHANICAL PROPERTIES IN SHEAR TESTS
E. I. Ilnitskaya *In its* Mech. Properties of Rocks 1968 p 28–33 refs (See N69-21433 10-13)
Copyright. Avail: CFSTI

Shear resistance of rocks was based on a method of shearing the specimens in beveled dies with simultaneous application of a varying compressive load onto the shearing plane. The influence of specimen size on shearing test results was investigated. Large slabs of gabbro and marble were selected because of their relative uniformity. From each slab sufficient cores were obtained with diameters of 10, 22, 40, 50, and 70 mm. The faces were ground on a revolving table with abrasive powder and lapped on glass with abrasive paste. All specimens were tested for shear at two different angles of the shearing plane to the horizontal, viz., 50° and 70°. Failure was achieved by continuous load increase. When the size of tested rock specimens was increased, the obtained results for ultimate shearing strength appeared reduced, approaching an asymptote at which the size factor ceases to affect the strength. It was concluded that there is a characteristic minimum for every rock, which depends on cleavage, fissuring, porosity, and structural uniformity, as well as on the relative extent and distribution of each of these defects. B.P.

N69-21438# Israel Program for Scientific Translations, Ltd., Jerusalem.
METHODS OF INVESTIGATING THE MECHANICAL PROPERTIES OF ROCKS UNDER TRIAXIAL (VOLUMETRIC) STRESS
M. M. Protodyakonov et al *In its* Mech. Properties of Rocks 1968 p 34–56 refs (See N69-21433 10-13)
Copyright. Avail: CFSTI

Experimental methods and programs for studying the properties of rocks under triaxial stress are reviewed. A unit for testing the lateral thrust of soft rocks and a chamber for determining the strength properties of soft rocks are briefly discussed. The information received from scientists on the development of equipment in their respective institutions for testing properties under triaxial stress is summarized. B.P.

N69-21439# Israel Program for Scientific Translations, Ltd., Jerusalem.
RECORD GRAPHS OR "CERTIFICATES" OF COAL STRENGTH
E. I. Ilnitskaya *In its* Mech. Properties of Rocks 1968 p 57–63 refs (See N69-21433 10-13)
Copyright. Avail: CFSTI

Strength certificates of coal, showing the relationship of normal and ultimate tangential stresses, were prepared. An analysis of the experimental data revealed the following: (1) The strength of anthracites, Kizel coal, and rhebdopissaites is very much the same, and all these coals are very strong. However, these coals differ in their deformation properties. Strength certificates for coking and steam coals show low cohesion and a high internal friction coefficient. (2) With rising resistance to pure shear the internal friction coefficient is reduced. (3) All coals are very brittle and have a very low tensile strength, which is only a small fraction of their uniaxial compression and shearing strengths. (4) Considering the enormous effect of the size factor on the tensile strength, it seems expedient to carry out tests on large coal blocks, fissured, as far as possible, to the same extent as the original deposits. Author

N69-21440# Israel Program for Scientific Translations, Ltd., Jerusalem.
DETERMINATION OF STRENGTH AND ELASTIC PROPERTIES OF COUNTRY ROCK AND COAL OF THE LENINSK–KUZNETSK BITUMINOUS-COAL DEPOSITS OF THE KUZNETSK BASIN (KUZBASS)
G. I. Yagodkin et al *In its* Mech. Properties of Rocks 1968 p 64–73 refs (See N69-21433 10-13)
Copyright. Avail: CFSTI

Various research facilities studied the physicomechanical properties of the Kuzbass rocks and coals. Their investigations are reviewed and research results tabulated. Data on specimen samples of aleurolites, sandstones, argillites, and coals revealed their compression and tensile strengths, Shore hardness, Poisson's ratio, strength number, moisture content, and modulus of deformation and stress. The three types of coal tested do not differ much in their mechanical properties. The five types of aleurolites were divided into three groups: the weakest with a uniaxial compression strength of 100 kg/cm^2 and a stamping strength number of 1.0; the second group with a strength of 375 to 650 kg/cm^2 and a number of 4.5 to 4.9; and the third with a strength of 750 kg/cm^2 and a stamping strength number of 8.3. The compression strengths of the seven types of argillites varied from 280 to 800 kg/cm^2, and their stamping strength number from 3 to 6. The two types of sandstones have approximately the same uniaxial compression strength of 500 to 600 kg/cm^2. The modulus of elasticity of the six tested rocks ranged from 0.4×10^{-5} to 1.8×10^{-5} kg/cm^2 and their Poisson's ratio from 0.2 to 0.3. B.P.

N69-21441# Israel Program for Scientific Translations, Ltd., Jerusalem.
QUICK COMBINED METHOD OF DETERMINING MECHANICAL PROPERTIES OF ROCKS
M. I. Koifman *In its* Mech. Properties of Rocks 1968 p 74–86 refs (See N69-21433 10-13)
Copyright. Avail: CFSTI

A quick method was developed for the combined determination of strength, deformation, and resistance of rocks, including coal. The particular feature of the method is that the test pieces for all tests are obtained mainly by repeated controlled splitting of the same specimen; the splitting itself serving as a quick method of measuring the tensile strength. The test pieces for uniaxial compression, bending, creep, etc. are thus obtained in the process of tensile testing. Investigations of mechanical properties of rocks and coals by this method may be carried out on plates with two parallel surfaces, cylindrical cores, and fragments or coarsely cut pieces. Apparatus was developed for performing tests by this quick method. Experimental investigations on various sedimentary, igneous, and metamorphic rocks proved that the method yields data correctly expressing the mechanical properties of rocks. Author

N69-21442# Israel Program for Scientific Translations, Ltd., Jerusalem.

NEW METHOD OF INVESTIGATING THE STRENGTH PROPERTIES OF TYPICAL ROCKS IN SOME COAL AND SHALE DEPOSITS

M. I. Koifman et al *In its* Mech. Properties of Rocks 1968 p 87–96 refs (See N69-21443 10-13)

Copyright. Avail: CFSTI

An effective method was applied in testing the strength of coals, combustible shales, aleurolites, sandstones, and limestones of low or medium strength. The method is distinguished by its simplicity and by the fact that several tensile and compression tests can be performed on each specimen. The new method was the first to afford a means of testing the strength of weak and fissured rocks or coals from which test pieces for testing by previously known methods cannot be prepared in practice, and which, as a consequence, could not be tested. A ratio of compression strength to tensile strength was determined for the samples tested; this ratio is an indicator for plasticity or brittleness. Author

N69-21443# Israel Program for Scientific Translations, Ltd., Jerusalem.

INDIRECT METHODS OF DETERMINING THE TENSILE STRENGTH OF ROCKS

A. P. Stepanov *In its* Mech. Properties of Rocks 1968 p 97–100 (See N69-21433 10-13)

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Specially shaped rock specimens and a gripping fixture for holding the specimens were designed. A special wedge indentation testing unit for determining the tensile strength was described, on which shearing and bending tests can also be performed for comparisons. The wedge displacement was measured to an accuracy of 0.001 mm in the new unit. B.P.

N69-21444# Israel Program for Scientific Translations, Ltd., Jerusalem.

ELEMENTARY FRACTURE AND MINERALOGICAL AND PETROGRAPHICAL PECULIARITIES OF ROCKS

M. I. Koifman et al *In its* Mech. Properties of Rocks 1968 p 101–108 refs (See N69-21433 10-13)

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The splitting methods of tensile strength testing were successfully applied in studying the effect of mineralogical and petrographical features on rock strength. The tensile strength of a rock, in its individual regions, is decisively affected by: (1) the cleavage of the rock forming minerals and the orientation of the cleavage planes to the failure surface; (2) the development of pores, voids, fissures, and other structural defects; (3) the grain size; and (4) the extent of weathering. The strength of a rock is reduced by the presence of large amounts of mica, in particular when it is in the form of extended accumulations parallel to the failure plane. When feldspar predominates, the numerical values for tensile strength are reduced whenever the feldspar crystals are oriented parallel to the failure plane and split along their cleavage. It was proved by direct measurements that the tensile strength of a rock increases with decreasing grain sizes of the predominating minerals and greatly decreases with weathering and formation of secondary minerals; it also decreases in zones where pores or other structural defects develop. Author

N69-21445# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE SIZE FACTOR IN ROCK PRESSURE INVESTIGATIONS

M. I. Koifman *In its* Mech. Properties of Rocks 1968 p 109–117 refs (See N69-21433 10-13)

Copyright. Avail: CFSTI

The results of investigations into the size factor as affecting the strength of rocks, carried out for the purpose of solving rock pressure problems, are in contradiction to known laws governing the strength variation of solids with their size. A new hypothesis was put forward, on which all theoretical considerations and practical calculations should be based. According to this hypothesis: (1) The variation of rock strength with size is governed by the summary effect of two size factors, viz., by a volume and a surface size effect. (2) The volume effect predominates in rocks, just as in other solids, and tends to reduce the strength with increased size. (3) Under uniaxial compression, the strength of a rock may, with increased size, either decrease (when the surface effect is small) or somewhat increase (when the effect of surface defects predominates), or even remain unchanged (when the effects compensate each other). (4) Under tensile stresses the natural structural deficiencies will have a particularly strong effect and will weaken the rock. (5) For systematic investigations into the size effect in various rocks and coals the method of repeated successive splitting or compression may be applied. Author

N69-21446# Israel Program and Scientific Translations, Ltd., Jerusalem.

INVESTIGATIONS OF THE EFFECT OF SPECIMEN DIMENSIONS AND ANISOTROPY ON THE STRENGTH OF SOME COALS IN THE DONETS AND KUZNETSK BASINS

M. I. Koifman et al *In its* Mech. Properties of Rocks 1968 p 118–129 refs (See N69-21433 10-13)

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The new combined method of multiple tensile stressing and compression demonstrated a considerable effect of size and anisotropy on the mechanical properties of several varieties of Donets and Kuznetsk basin coals. The tests showed that the tensile strength greatly decreased with increased size. The size has a smaller effect in compression. The combined method of splitting and compression may be successfully applied for investigating the anisotropy of mechanical properties in coals from various deposits and under different types of stress. The size effect differed depending on the orientation of the applied load. The experimental results obtained for coals are in good agreement with the new hypothesis on the existence of two size defects. Author

N69-21447# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE SIZE FACTOR IN THE STRENGTH OF ROCKS AS RELATED TO THEIR PETROGRAPHIC STRUCTURE

M. I. Koifman et al *In its* Mech. Properties of Rocks 1968 p 130–137 refs (See N69-21433 10-13)

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Tests on a variety of sedimentary, igneous, and metamorphic rocks showed that their tensile strength always decreased with increased test piece dimensions. The reverse, i.e., a strength increase with increased dimensions, although sometimes occurring in compression, has never been observed in tensile tests. For very small dimensions (cross sections of 3 cm^2 down to 1 cm^2 or less) the effect leading to a tensile strength increase is particularly striking. The scattering of results is considerable when small specimens are tested and is gradually reduced with increased specimen dimensions. In testing fissured and compact argillites, gabbro, granites, and other rocks, it was shown that the varying effect of size is determined by geological and petrographical features and, above all, by cleavage and nonhomogeneity of structure and composition. The less a rock is homogeneous, the greater the effect of size. Author

N69-21448# Israel Program for Scientific Translation, Ltd., Jerusalem.
CONTACT CHANGES IN TESTED AND DISRUPTED ROCKS
M. I. Koifman *In its* Mech. Properties of Rocks 1968 p 138–149 refs (See N69-21433 10-13)
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Contact compaction or strengthening was detected and measured in tests on a number of sedimentary, igneous, and metamorphic rocks, and fossil coals. The effect was studied under conditions of both dynamic and static indentation on Shore and Brinell testers, respectively. Test results are reviewed and some of the conclusions were: (1) When a concentrated load is applied to a rock, phenomena of local compaction take place in the area of contact with the load transmitting body. (2) Contract strengthening occurred in a rock under a locally applied static or dynamic load. (3) In hard rocks and coals the contact strengthening may lead to failure. Beyond this contact zone fissures may form in brittle rocks, creating a disruption zone. (4) A considerable contact strengthening occurs in loose, very porous and highly plastic rocks, resulting in double or even eightfold Shore hardness. B.P.

N69-21449# Israel Program for Scientific Translations, Ltd., Jerusalem.
DETERMINATION OF BRITTLENESS AND PLASTICITY OF ROCKS BY REPEATED INDENTATION
M. I. Koifman et al *In its* Mech. Properties of Rocks 1968 p 150–158 refs (See N69-21433 10-13)
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For assessing rock brittleness and plasticity under dynamic indentation, a new method was developed, which is based on measuring the contact strengthening, that is, the increase in hardness under successive impact indentation produced by repeated striking onto the same point. Successive impact and rebound tests produced results that were, in most cases, in good agreement with those obtained by plunger indentation for assessing brittleness and plasticity. It was found in such impact and rebound tests that, in a great variety of rocks, water saturation leads to reduced hardness and increased plasticity. The method is recommended for testing brittleness and plasticity both in field practice and in the laboratory. Author

N69-21450# Israel Program for Scientific Translations, Ltd., Jerusalem.
DETERMINATION OF ROCK HARDNESS, AS RELATED TO COMPONENT MINERALS, BY THE IMPACT-AND-REBOUND METHOD
P. V. Vasilev *In its* Mech. Properties of Rocks 1968 p 159–163 (See N69-21433 10-13)
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Hardness values for a number of granites are analyzed, as well as for quartz, feldspar, and mica, all components of granite. These values were produced by an impact and rebound method; the apparent divergences in the tabulated results are discussed. The scattering of the readings were found to occur when nonuniform, fine grained rocks were blindly struck. In this case the hardness must be determined by the separated areas of different composition or structure, with their relative extent taken into account. It was stated that the hardness of a mineral is decisively affected by its state of preservation. B.P.

N69-21451# Israel Program for Scientific Translations, Ltd., Jerusalem.
MECHANICAL PROPERTIES AND DRILLABILITY OF ROCKS
M. M. Protodyakonov *In its* Mech. Properties of Rocks 1968 p 164–176 refs (See N69-21433 10-13)
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For assessing the drillability of a rock its hardness, plasticity, and abrasiveness must be known. In percussion drilling, hardness and plasticity are the decisive factors, while in rotary drilling the decisive factors are hardness and abrasiveness. Strength and deformability were determined by quick methods, that is, by stamping by means of a falling weight, or by striker impact and rebound. Hardness and abrasiveness were determined by the PTA test set, in which the axial feed force is measured. Under optimum drilling conditions the drilling time is proportional to the square of the drilled diameter, is a linear function of the rock strength, and is inversely proportional to the drill power. All drilling scales are correlated with each other and with the strength number. A universal drillability scale should be based on the dynamic hardness determined by a standard percussion drill operating under standardized conditions. Author

N69-21453# Kakioka Magnetic Observatory (Japan).
GEOMAGNETIC OBSERVATIONS AT MEMAMBETSU, JAPAN IN 1963
1968 119 p refs
(Rept-54) Avail: CFSTI

Data of the geomagnetic observations of the Kakioka Magnetic Observatory at Memambetsu, Japan are presented. Tables of hourly observations and magnetograms for 1963 are included. F.O.S.

N69-21481# Israel Program for Scientific Translations, Ltd., Jerusalem.
OCEANOGRAPHIC RESEARCH BY THE "VITYAZ" IN THE NORTH PACIFIC UNDER THE IGY PROGRAM [OKEANOLOGICHESKIE ISSLEDOVANIYA VITYAZYA V SEVERNOI CHASTI TIKHOGO OKEANA PO PROGRAMME MEZHDUNARODNOGO GEOFIZICHESKOGO GODA]
N. N. Sysoev, ed. 1969 301 p refs Transl. into ENGLISH from Tr. Inst. Okeanol. Akad. Nauk SSSR (Moskva, USSR), v. 45, 1961 Published for US Dept. of Commerce and NSF
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CONTENTS:

1. NEW BATHYMETRIC DATA ON THE NORTHEASTERN PACIFIC N. L. Zenkevich p 3–17 refs (See N69-21482 10-13)

2. SEDIMENTS IN THE NORTHEASTERN PACIFIC N. S. Skornyakova p 18–62 refs (See N69-21483 10-13)

3. QUANTITATIVE DISTRIBUTION OF BENTHIC FORAMINIFERS IN THE NORTHEASTERN PACIFIC Kh. M. Saidova p 63–68 refs (See N69-21484 10-13)

4. Eh AND pH OF SEDIMENTS IN THE NORTHEASTERN PACIFIC E. A. Romankevich et al p 69–82 refs (See N69-21485 10-13)

5. HYDROLOGICAL CONDITIONS IN THE NORTHEASTERN PACIFIC, AUTUMN–WINTER 1958–1959 V. A. Shirei p 83–93 refs (See N69-21486 10-13)

6. SOME DETAILS OF THE THERMAL STRUCTURE OF THE SUPERFICIAL WATER LAYER IN THE OCEAN P. P. Hanson p 94–98 (See N69-21487 10-13)

7. WATER TRANSPARENCY IN RELATION TO CURRENTS IN THE NORTHEASTERN PACIFIC M. V. Kozlyaninov et al p 99–109 refs (See N69-21488 10-13)

8. FEATURES OF THE CIRCULATION OF INTERMEDIATE WATERS IN THE NORTH PACIFIC K. A. Chekotillo p 110–119 refs (See N69-21489 10-13)

9. VERTICAL WATER MOVEMENTS OFF THE PACIFIC NORTH AMERICAN COAST K. A. Chekotillo p 120–126 refs (See N69-21490 10-13)

10. SOME HYDROCHEMICAL FEATURES OF THE NORTHEASTERN PACIFIC OCEAN ACCORDING TO OBSERVATIONS IN THE WINTER OF 1958–1959 D. A. Smatanin p 127–138 refs (See N69-21491 10-13)

11. ZOOPLANKTON OF THE NORTHEASTERN PACIFIC OCEAN IN THE WINTER OF 1958–1959 K. V. Beklemishev p 139–172 refs (See N69-21492 10-13)

12. SPECIFIC COMPOSITION OF THE PHYTOPLANKTON AND PRIMARY PRODUCTION IN THE NORTHEASTERN PACIFIC OCEAN IN THE WINTER OF 1958–1959 O. I. Kabanova-Mishke p 173–180 refs (See N69-21493 10-13)

13. QUANTITATIVE DISTRIBUTION OF DEEPWATER BENTHOS IN THE NORTHEASTERN PACIFIC OCEAN Z. A. Filatova et al p 181–215 refs (See N69-21494 10-13)

14. QUANTITATIVE DISTRIBUTION OF POLYCHETES (POLYCHAETA) IN THE NORTH PACIFIC OCEAN R. Ya. Levenshtein p 216–224 refs (See N69-21495 10-13)

15. DISTRIBUTION OF THE ECOLOGICAL FORMS OF SALLEEMAN (VELELLA LATA CH. AND EYS.) AND PORTUGUESE MAN-OF-WAR (PHYSALIA UTRICULUS ESCH.) IN THE NORTH PACIFIC OCEAN A. I. Sevilov p 225–242 refs (See N69-21496 10-13)

16. NEW DATA ON THE SPECIFIC COMPOSITION AND DISTRIBUTION OF DEEP-SEA PENNATULARIA, GENUS KOPHOBELEMNON, IN THE NORTH PACIFIC F. A. Pasternak p 243–262 refs (See N69-21497 10-13)

17. DISTRIBUTION OF DEEP-SEA FISHES IN THE UPPER BATHYPELAGIC LAYER OF THE SUBARCTIC WATERS OF THE NORTH PACIFIC N. V. Parin p 263–284 refs (See N69-21498 10-13)

18. FOOD OF YOUNG SAURY (COLOLABIS SAIRA) E. A. Lubny-Gertsyk p 285–289 refs (See N69-21499 10-13)

N69-21482# Israel Program for Scientific Translations, Ltd., Jerusalem.

NEW BATHYMETRIC DATA ON THE NORTHEASTERN PACIFIC

N. L. Zenkevich *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 3–17 refs (See N69-21481 10-13)

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Bottom topography as determined from bathymetric data gathered on the 1958–59 voyage of the Soviet oceanographic vessel Vityaz, is described. Commencing from the coast of Japan, the ship crossed the Kurile–Kamchatka Trench, intersecting with the Hawaiian Ridge, and continued across into the Aleutian Trench area and the Gulf of Alaska, then moving southeastward down the North American coast. A brief summary is also included of American bathymetric investigations in the northeastern Pacific, some of which resulted in the discovery of fracture zones on the ocean floor; these are deep faults and displacements in the earth's crust characterized by their high seismic activity. The Soviet and American data were incorporated into a large scale bathymetric chart of the bottom characteristics of the northeastern Pacific which shows the continental slope, level deep plains, areas of very rough, serrated relief, fracture zones, deep trenches, and large seamounts. In addition, the chart indicates the four geomorphological provinces distinguished by earlier American investigations. These include: Gulf of Alaska seamount province; the ridge and trough province (40°N–52°N, 127°W–137°W); the deep plain area (33°N–40°N, 122°W–132°W); and the Baja California seamount province located south of 33°N. A brief discussion is also included on the differences found in the floor surface west of the Hawaiian Islands from that in the northeastern Pacific. A.C.R.

N69-21483# Israel Program for Scientific Translation, Ltd., Jerusalem.

SEDIMENTS IN THE NORTHEASTERN PACIFIC

N. S. Shcmyakova *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 19–52 refs (See N69-21481 10-13)

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Characteristics of the superficial layer of sedimentation, as determined by sample data collected by the Soviet research vessel Vityaz during the period 1956–1958 and published results of other non-Soviet oceanographic expeditions, are described. The five factors which control recent sedimentation in this region are: (1) topography, climate and soils on the adjacent land which determine the nature and quantity of terrigenous material deposited; (2) the presence of a recent volcanic belt along the ocean margin and the seismic activity of the region; (3) luxuriant development of plankton in subarctic waters; (4) the particular topography of the northeastern Pacific; and (5) hydrodynamic conditions. Five types of sediment were encountered: polygenic; organogenic; terrigenous; terrigenous–volcanic; and chemogenic. Sample analysis indicated that the area is characterized by extensive occurrence of red clays and a limited amount of carbonate sediments; that the North Pacific contains a belt of high latitudinal, slightly diatomaceous muds; that most of the terrigenous sediments have a high manganese content; and that the extensive occurrence of manganese nodules, giant shark teeth, and phillipsite in the southern regions indicate very slow sedimentation rates. A.C.R.

N69-21484# Israel Program for Scientific Translations, Ltd., Jerusalem.

QUANTITATIVE DISTRIBUTION OF BENTHIC FORAMINIFERS IN THE NORTHEASTERN PACIFIC

Kh. M. Saidova *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 53–68 refs (See N69-21481 10-13)

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Based on data collected by expeditions of the Soviet research vessel Vityaz during the period 1957–1958 in the Sea of Okhotsk, Bering Sea, Sea of Japan, and the northwestern Pacific, a summary is presented on the quantitative distribution and ecology of benthic foraminifers in these areas. The summary includes data on calcareous (secretion) and arenaceous (agglutinized) samples over all of the regions studied. A.C.R.

N69-21485# Israel Program for Scientific Translations, Ltd., Jerusalem.

Eh AND pH OF SEDIMENTS IN THE NORTHEASTERN PACIFIC

E. A. Romankevich et al *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 69–82 refs (See N69-21481 10-13)

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A study of the redox potential (Eh) and hydrogen ion concentration (pH) of bottom sediments was conducted due to the importance of these physicochemical properties in the processes of authigenic mineral formation and diagenesis. The data were collected by the research vessel Vityaz during its 1958–59 expedition in the northeastern Pacific deep basin at depths exceeding 4000 to 5000 m, using 28 cores for determining Eh, pH, moisture, bulk density of dry and wet samples, as well as soluble ferric and ferrous ions. Eh and pH values were determined electrometrically in wet sediments immediately after lithological observation of the cores; at the same time, measurements were also made of ferrous and total soluble iron content of the samples. The results of the analyses are presented in graphic and tabular form. A.C.R.

N69-21486# Israel Program for Scientific Translations, Ltd., Jerusalem.

HYDROLOGICAL CONDITIONS IN THE NORTHEASTERN PACIFIC, AUTUMN–WINTER 1959–1960

V. A. Shirei *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 83–93 refs (See N69-21481 10-13)

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Hydrological measurements were made by the research vessel Vityaz during its 1958–59 expedition to determine temperature, salinity and water mass distribution. For temperature and salinity distribution, charts were constructed for horizons from surface to 50, 100, 250, 500, 1000, and 2000 m, all of which indicated that both of these hydrological factors vary with latitude at all horizons. Analysis of water mass distributions revealed the presence of subarctic, subtropical, transitional zone, and tropical water masses in the eastern Pacific. The subarctic and subtropical water masses were subdivided into several varieties genetically related to the main ones, but possessing their own characteristics. The transitional zone is intermediate between the subtropical and the subarctic waters and is apparently formed by the mutual interpenetration of the North Pacific and Aleutian currents, as well as by lateral mixing to form a broad frontal zone. The flow of the current in each of the water mass areas was also analyzed. A.C.R.

N69-21487# Israel Program for Scientific Translations, Ltd., Jerusalem.

SOME DETAILS OF THE THERMAL STRUCTURE OF THE SUPERFICIAL WATER LAYER IN THE OCEAN

P. P. Hanson *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 94–98 (See N69-21481 10-13)
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During the 1958–59 expedition of the research vessel Vityaz, a new continuously recording instrument, known as the electrobathythermosounder, was used to study the thermal structure of the ocean. Thermal sounding using this instrument enabled a comparison of the previous theories on the vertical temperature distribution in the ocean, which were based on data collected by reversing mercury thermometers, and confirmed the high incidence of details which had not been previously recorded, even with the use of earlier types of continuous recorders, such as the bathythermograph, resistance thermometer, and thermistor. To demonstrate the increased detail which may be obtained using such an instrument, an analysis of the thermal structure of the thermocline is presented, including data on its upper and lower boundaries and stepwise structure which had heretofore not been positively identified. A.C.R.

N69-21488# Israel Program for Scientific Translations, Ltd., Jerusalem.

WATER TRANSPARENCY IN RELATION TO CURRENTS IN THE NORTHEASTERN PACIFIC

M. V. Kozlyaninov et al *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 99–109 refs (See N69-21481 10-13)
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Water transparency, represented as a definite physical quantity equal to the coefficient of light transmission by a water layer of unit thickness, was investigated during the 1958–59 expedition of the research vessel Vityaz. Thus defined, transparency is directly related to the attenuation index, one of the most important optical parameters of water. For surface layers, transparency was determined by lowering an instrument into the sea; for large depths, samples of seawater were used. Analyses of the measurements led to the following conclusions: (1) Different water masses transported by currents possess definite transparency values. (2) Uniform transparency shows that the water masses transported by currents spread to large depths, even to the ocean floor. (3) Transparency drops abruptly in mixing zones, in front zones, this is traced down to considerable depths (2000 to 3000 m). (4) A heavy southward flow of water can be traced distinctly on the dynamic section along 29°N between 127°W and 140°W. Transparency distribution studies show that this flow consists of two structures: the western one relating to waters of the North Pacific current, while the eastern one belongs to those of the California current. A.C.R.

N69-21489# Israel Program for Scientific Translations, Ltd., Jerusalem.

FEATURES OF THE CIRCULATION OF INTERMEDIATE WATERS IN THE NORTH PACIFIC

K. A. Chekotillo *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 110–119 refs (See N69-21481 10-13)
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A technique for studying circulation in the intermediate layer of the ocean is described, based on dynamic calculation of sea currents and the method of isopycnic analysis, which was used to analyze winter circulation data gathered by the 1958–59 expedition of the research vessel Vityaz. The intermediate layer is defined as that lying approximately between depths of 300 and 2000 to 3000 m and is characterized by relatively insignificant reactions to seasonal, and, particularly, to transient and random meteorological factors. The 2000 decibar isobar was adopted as the location depth of the relative isobaric surface, and dynamic charts were constructed for isobaric surfaces relative to this standard. These charts indicated differences in dynamic topography from those constructed using other methods; and particular emphasis is placed on the apparent presence of northern flows in the California current system, designated as the Californian deep countercurrent. A.C.R.

N69-21490# Israel Program for Scientific Translations, Ltd., Jerusalem.

VERTICAL WATER MOVEMENTS OFF THE PACIFIC NORTH AMERICAN COAST

K. A. Chekotillo *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 120–128 refs (See N69-21481 10-13)
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Simplified equations for determining the vertical movement of waters are presented, based on the steady state mean turbulent movement of a viscous fluid, which constitutes an Ekman system. Equations for deriving the boundary conditions on the sea surface are also included, as well as formulas for examining the gradient current. Using data gathered during the 1958–59 expedition of the research vessel Vityaz, the calculations were applied to studies of the latitudinal distribution of relative specific volume, and its fluctuation at depth 2000 m over six latitudinal sections is tabulated. Charts are also presented for the distribution of vertical velocity components of gradient currents over various horizons and latitudinal sections. A.C.R.

N69-21491# Israel Program for Scientific Translations, Ltd., Jerusalem.

SOME HYDROCHEMICAL FEATURES OF THE NORTHEASTERN PACIFIC OCEAN ACCORDING TO OBSERVATIONS IN THE WINTER OF 1958–1959

D. A. Smetanin *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 127–138 refs (See N69-21481 10-13)
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The distribution of oxygen and phosphates during the winter, 1958–59, as determined from data gathered by the research vessel Vityaz, is analyzed, with brief attention to the distribution of silicon. Minimum and maximum oxygen concentration is determined for surface conditions and at various depths and latitudes, with both vertical and horizontal distribution included. Phosphate and silicon distribution is also analyzed based on surface concentration, as well as that for various depths and latitudinal sections. A.C.R.

N69-21492# Israel Program for Scientific Translations, Ltd., Jerusalem

ZOOPLANKTON OF THE NORTHEASTERN PACIFIC OCEAN IN THE WINTER OF 1958–1959

K. V. Beklemishev *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 139–172 refs (See N69-21481 10-13)

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During the 1958–59 cruise of the research vessel Vityaz, a total of 1114 samples of zooplankton from 182 stations were obtained, using Juday nets of 37 mesh at standard horizons. These samples were weighed after collection in small pieces of 37 mesh silk net, and wet weight of seston per m^3 was derived. Of the 1114 samples, 93 were taken from depths below 500 m. Based on this data, the qualitative composition of the zooplankton along separate sections of latitude was determined, and notes are included on the distribution of individual species in various sections. The biogeographical division of the pelagic zones in the northeastern Pacific and the changes in plankton communities with transformation of water masses were also determined. A.C.R.

N69-21493# Israel Program for Scientific Translations, Ltd., Jerusalem.

SPECIFIC COMPOSITION OF THE PHYTOPLANKTON AND PRIMARY PRODUCTION IN THE NORTHEASTERN PACIFIC OCEAN IN THE WINTER OF 1958–1959

O. I. Koblents-Mishke *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 173–190 refs (See N69-21481 10-13)

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Preliminary results of data gathered during the 1958–59 cruise of the research vessel Vityaz are presented, concerning the qualitative composition and distribution of individual forms and the determination of primary production. Studies of the species composition of phytoplankton were based on analysis of several groups divided according to their distribution: those encountered over the entire region covered; boreal species distributed in the northern part of the region; and tropical species distributed in the southern areas. The techniques and measurement methods used in determining primary production are described, and the degree of measurement error was evaluated. These results were then discussed as to production on the surface and at various water depths, as well as factors influencing fluctuation in production. A.C.R.

N69-21494# Israel Program for Scientific Translations, Ltd., Jerusalem.

QUANTITATIVE DISTRIBUTION OF DEEPWATER BENTHOS IN THE NORTHEASTERN PACIFIC OCEAN

Z. A. Filatova et al *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 191–215 refs (See N69-21481 10-13)

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As a part of its 1958–59 expedition, the research vessel Vityaz gathered data on the quantitative distribution of deepwater benthos in abyssal zones, an area of oceanographic research heretofore relatively unexplored. The area covered lay east of the 180th meridian and north of 20°N; in addition, several bottom samples were obtained on a latitudinal section west of the Hawaiian Islands, which enabled combination of the results of quantitative research on benthos accomplished in the western and eastern parts of the ocean. The data gathered from this expedition were examined and linked with analogous findings for the northwestern part of the Pacific. It was found that, in general, the benthic biomass for both areas of the Pacific is not distributed uniformly, and the possible factors causing this condition were analyzed. These factors include depth, amount of bottom food available, topological variations, and composition of bottom sediment. A.C.R.

N69-21495# Israel Program for Scientific Translation, Ltd., Jerusalem.

QUANTITATIVE DISTRIBUTION OF POLYCHETES (POLYCHAETA) IN THE NORTH PACIFIC OCEAN

R. Ya. Levenshtein *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 216–224 refs (See N69-21481 10-13)

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Polychete sampling, most of which was accomplished at great depths, is discussed and tabulated from the period 1953–1959. Analyses indicate a fairly irregular distribution for the North Pacific, corresponding to the varied physical and geographical conditions. In addition, a correlation between the distribution of the biomass for benthos and that for polychetes for this area was found; the highest biomass was observed in nearshore areas, dropping off to very low densities, on a average of 0.05 g/m^2, in the open sea; a definite decrease in polychete biomass also is evident with increasing depth. For the entire northern Pacific, a decrease was observed in the general biomass from north to south and from the coasts to the center, while the northwestern part of the ocean is characterized by a higher density than the northeastern part. A.C.R.

N69-21496# Israel Program for Scientific Translations, Ltd., Jerusalem.

DISTRIBUTION OF THE ECOLOGICAL FORMS OF SALLEEMAN (VELELLA LATA CH. AND EYS.) AND PORTUGUESE MAN-OF-WAR (PHYSALIA UTRICULUS ESCH.) IN THE NORTH PACIFIC OCEAN

A. I. Savilov *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 225–242 refs (See N69-21481 10-13)

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A large area north of the equatorial countercurrent and east of the 180° meridian, including the coastal regions of the Aleutian Islands and North America, was covered by the research vessel Vityaz during its 1958–59 cruise, and a considerable pleuston collection was gathered. This sampling allowed analyses on the northern boundary of distribution for the Salleeman and Portuguese Man-of-War and their ecological forms and distribution. On the basis of the collected material, it was concluded that definite boundaries for the distribution of the different ecological forms of Velella and Physalia cannot be definitely established, but it appears that the qualitative and quantitative distribution of pleuston fauna is determined by latitudinal zones, specifically by the distribution of abiotic factors of the water and air media in these zones. These conclusions are then compared with previous theories on the distribution of the pleuston fauna in the ocean. A.C.R.

N69-21497# Israel Program for Scientific Translations, Ltd., Jerusalem.

NEW DATA ON THE SPECIFIC COMPOSITION AND DISTRIBUTION OF DEEP-SEA PENNATULARIA, GENUS KOPHOBELEMNON, IN THE NORTH PACIFIC

F. A. Pasternak *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 243–262 refs (See N69-21481 10-13)

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Representatives of the family Kophobelemnonidae were detected for the first time in the North Pacific, specifically in the region of the Kurile-Kamchatka Trench, the western part of the Bering Sea, the central coast of North America, and eastern area of the East China Sea, during the 1958–59 expedition of the research vessel Vityaz. The data collected are used to present evidence that prior division of the family into two genera, Schlerobelemnon and Kophobelemnon, is without sufficient foundation, and that only one genus, Kophobelemnon, is distinguishable. According to the analysis, this genus may then be

divided into two subgenera, Eukophobelemnon and Sclerobelemnon. Specific description of the specimens collected during the expedition is then given for four species of the subgenus Eukophobelemnon; the fifth species is not included. These species are identified as: Eukophobelemnon affine studer, biflorum Pasternak, pauciflorum Hickson, and stelliferum. A.C.R.

N69-21498# Israel Program for Scientific Translations, Ltd., Jerusalem.

DISTRIBUTION OF DEEP-SEA FISHES IN THE UPPER BATHYPELAGIC LAYER OF THE SUBARCTIC WATERS OF THE NORTH PACIFIC

N. V. Parin *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 263–284 refs (See N69-21481 10-13)

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In the region covered by the research vessel Vityaz during this study, catches taken within the upper 500 m depths were used to determine the composition of the ichthyofauna; in subsequent analysis of the distribution of the fishes, specimens gathered from greater depths were also considered. In addition, since it is known that the vertical distribution of bathypelagic fishes is subject to considerable diurnal fluctuation, catches were also made of those that migrate to the surface during the night. From analysis of the collections, it was concluded that the ichthyofauna of the area under study is characterized by: (1) a quantitative impoverishment of species (about 40 in all); (2) considerable isolation evident in the presence of a number of endemic genera and species; (3) uniformity within the limits of the North Pacific subarctic waters, based on similarities in the main hydrological features; and (4) existing differences in the fauna of the northeastern and northwestern parts of the ocean, apparently resulting from variations in the oxygen environments. A.C.R.

N69-21499# Israel Program for Scientific Translations, Ltd., Jerusalem.

FOOD OF YOUNG SAURY (COLOLABIS SAIRA)

E. A. Lubny-Gertsyk *In its* Oceanog. Res. by the Vityaz in the N. Pacific under the IGY Program 1969 p 285–289 refs (See N69-21481 10-13)

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A diet study of the saury larvae was included in the 1958–59 expedition of the research vessel Vityaz due to the lack of existing information concerning the biology of the young fishes. The data included are considered preliminary in nature, because the material collected was obtained on the standard sections covered by the ship and not at locations of larval concentration. The data are presented in the form of descriptions for each development stage, as previously defined for the growth phases of bony fishes. A.C.R.

N69-21515# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.

GROUND-BASED MICROWAVE RADIOMETRY FOR RECOVERY OF AVERAGE TEMPERATURE PROFILES OF THE ATMOSPHERE

M. D. Pearson and W. T. Kreiss Dec. 1968 68 p refs

(AD-682051; D1-82-0781) Avail: CFSTI CSCL 4/2

Calculations and analyses are presented to demonstrate the feasibility of inverting multi-frequency brightness temperature measurements obtained with an oxygen-band radiometer to recover the average kinetic temperature profile of the atmosphere. Special attention is given to cloud effects, radiation from above the atmospheric model, radiative-transfer equation solutions, effects of radiometer measurement errors on the profile recovery accuracy, and the selection of optimum observing frequencies. Recovered temperatures could be used to calculate pressure altitudes, which for a network of ground stations would provide the pressure gradient for calculating winds aloft. Such information is required for long-term numerical weather forecasting. Author (TAB)

N69-21529# Utah Univ., Salt Lake City. Upper Air Research Labs.

ROCKET INSTRUMENTATION FOR AURORAL MEASUREMENTS: AEROBEE 3.615

K. D. Baker, David A. Burt, Ralph H. Haycock, Karl G. Seljaas, Carl L. Howlett et al Sep. 1968 114 p refs

(Contract AF 19(628)-4995

(AD-681464; AFCRL-68-0538; UU-68-10; SR-10) Avail: CFSTI CSCL 4/1

An Aerobee rocket (3.615) was instrumented with a sophisticated array of devices for simultaneous, direct measurement of many parameters associated with the polar ionosphere during a visible auroral event. The instruments included electron and proton counters and sciotillators, electron and ion density and temperature probes, x-ray counters, and auroral light photometers. Details of the rocket payload and the 24 different sensors are presented. Author (TAB)

N69-21532# Aerospace Corp., El Segundo, Calif. Lab. Operations.

ACCURACY OF GEOID HEIGHTS FROM TRUNCATED STOKES' KERNELS, 1 NOVEMBER 1967–1 FEBRUARY

Lem Wong and Roger C. Gore 15 Jan. 1969 56 p refs

(Contract F04701-68-C-0200)

(AD-682304; TR-0200(4452)-2; SAMSO-TR-69-8) Avail: CFSTI CSCL 8/5

The dependence of the root-mean-square (rms) geoid height error on the truncation angle and the degree of the first term in the series expansion of a modified Stokes kernel is examined. It is shown that kernels with the lower degree terms removed have some advantage over the conventional kernel when a significant error in the zeroth degree term of the gravity anomaly expansion is present. Numerical estimates of rms geoid height error versus integration area size are obtained for several kernels. Author (TAB)

N69-21600# Sheffield Univ., (England). Dept. of Applied Mathematics and Computing Science.

THE MAGNETIC FIELD AND ENERGY OF AN AXISYMMETRIC VAN ALLEN BELT

S. Chapman (NCAR), P. C. Kendall, P. N. Swartztrauber (NCAR), and D. W. Windle Feb. 1968 28 p

(Grant AF-EOAR-74-64)

(AD-681438; SR-10; AFCRL-68-0645) Avail: CFSTI CSCL 4/1

In an earlier paper the magnetic vector potential of an axisymmetric distribution of azimuthal electric currents was expanded in a Legendre series. It was shown that the method may be used to study the magnetic field of a geomagnetic ring current of charged particles spiralling in a dipole field. The purpose of this further work is to determine the self magnetic energy for various model ring current belts. The pitch angle parameter alpha commonly used in such models is taken to be constant. Other parameters are ko, the distance (measured in earth radii) of the maximum particle density from the centre of the earth, and g1, g2, constants such that the particle density is proportional to exp(-g1 squared(R-ko)squared) for R < or = ko and to exp(-g2 squared(R-ko)squared) for R > or = ko; here R denotes the radial distance from the earths centre (measured in earth radii) in the dipole equatorial plane. Numerical results are given. The distribution of magnetic energy between the various harmonics is also given. Author (TAB)

N69-21607# National Physical Lab., New Delhi (India). Radio Propagation Unit.
IONOSPHERIC PREDICTIONS FOR MARCH 1969
Oct. 1968 5 p
(RRC-150) Avail: CFSTI

Graphs of predicted median foF_2 values and predicted median $MUF(4000)F_2$ values are presented, along with a nomogram for transforming F_2-zero-MUF and F_2-4000-MUF to equivalent maximum usable frequencies at intermediate transmission distances.
Author

N69-21608# National Physical Lab., New Delhi (India). Radio Propagation Unit.
IONOSPHERIC PREDICTIONS FOR FEBRUARY 1969
Oct. 1968 6 p
(RRC-B149) Avail: CFSTI

Graphs of predicted median foF_2 values and predicted median $MUF(4000)F_2$ values are presented, along with a nomogram for tranforming F_2-zero-MUF and F_2-40000-MUF to equivalent maximum usable frequencies at intermediate transmission distances.
Author

N69-21680# Stanford Research Inst., Menlo Park, Calif.
ANALYSIS OF MEDIUM- AND HIGH-FREQUENCY ATMOSPHERIC RADIO NOISE IN THAILAND Special Technical Report No. 37
Rangsit Chindahporn and E. Leroy Younker May 1968 88 p refs
(Contract DA-36-039-AMC-00040(E); ARPA Order-371)
(AD-681878) Avail: CFSTI CSCL 4/1

Measurements of atmospheric radio noise have been made in Thailand since early 1966 using equipment similar to the ARN-2 noise-measuring sets employed in the worldwide noise-measuring network coordinated by the Environmental Science Services Administration (ESSA) of the U.S. Department of Commerce. Emphasis is placed in this report on noise power measurements at 0.53, 2.3, 5.0, and 10.0 MHz. The analysis of data from almost two years of measurements shows that the variation in the magnitude of noise power from day to night in Thailand is typically 25 dB and indicates that a seasonal variation of about 10 dB is superimposed upon the diurnal effect. The day-to-day variation of noise power at any given hour is considerable. An investigation of the effects of local electrical storms--as indicated by lightning-flash counters--shows that the hour by average noise power tends to increase as the number of flash counts increases, and this effect is greater at the lower frequencies.
Author (TAB)

N69-21691# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
D-REGION PARAMETERS FROM CONTINUOUS WAVE, LOW-FREQUENCY, ROCKET PROPAGATION EXPERIMENTS DURING THE SOLAR ECLIPSE OF NOVEMBER 12, 1966 Final Report
Anton Mavretic 1 Sep. 1968 147 p refs
(Contract DAAD05-67-C-0005)
(AD-681885; SR-323) Avail: CFSTI CSCL 04/1

During the course of the total solar eclipse of November 12, 1966 in Cassino, Brazil a series of four rockets were fired carrying a continuous wave, low frequency propagation experiment to measure the rate of change of magnetic field strength with altitude. From this rate electron density profiles were deduced with the aid of a computerized full-wave solution technique. From the variation of electron density with time and a continuity equation for electrons the effective recombination coefficient was obtained in the altitude range from 64 to 73 km. From the known positive ion profiles during the same eclipse the negative ion to electron density ratio was deduced and used to obtain the effective ion-ion recombination coefficient versus altitude.
Author (TAB)

N69-21695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET AERIAL PHOTOGRAPHY AND OTHER TOPOGRAPHIC, GEODETIC AND CARTOGRAPHIC SURVEYS IN THE ANTARCTIC
B. V. Dubovskoi 21 May 1968 25 p refs Transl. into ENGLISH from Geod. i Kartografiya no. 6, 1966 p 51–61
(AD-681599; FTD-MT-24-61-68) Avail: CFSTI CSCL 8/2

For cartographic purposes, Antarctic was photographed by means of radial aerial traverses. Coastal regions with rock outcrops were completely photographed from the air; radio altimeter and statoscopic data were recorded at the same time. The scale of mapping varied from 1:30,000 to 1:60,000. Astronomical stations served as check points, while the centers of radial traverses were used as altitude control points. The remainder of Antarctica, nine tenths of the total area, was covered by a network of control strips linked to stations on the coast and to the astronomical stations in the interior.
Author (TAB)

N69-21714# National Physical Lab., New Delhi (India). Radio Propagation Unit.
IONOSPHERIC PREDICTIONS FOR APRIL 1969
Nov. 1968 5 p
(RRC-B150) Avail: CFSTI

Graphs of predicted median foF_2 values and predicted median $MUF(4000)F_2$ values are presented, along with a nomogram for transforming F_2-zero-MUF and F_2-4000-MUF to equivalent maximum usable frequencies at intermediate transmission distances.
Author

N69-21826# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN ANALOG COMPUTER SOLUTION OF THE WAVE INTERACTION EQUATION
M. J. Horwitz 10 Jan. 1969 66 p refs
(Contract NONR-656(35); Grants NSF-GA-1456; NSF-GP-5611)
(AD-681774; SR-332) Avail: CFSTI CSCL 4/1

The work presents an analog computer program to solve the radio wave interaction equation for the case of finite wanted and disturbing pulses with the disturbing pulse power having a time dependency of (Sin((Pi)(t)/tau sub D) to the 4th power. The program is capable of varying some of the important variables involved in the equation such as electron density, N, collision frequency, nu, and electron temperature, theta. Some typical curves are shown to demonstrate the accuracy and applicability of the program. Finally a critical analysis is presented which shows the advantages and disadvantages of the analog computer program.
Author (TAB)

N69-21832# Army Foreign Science and Technology Center, Washington, D. C.
EXPERIENCE IN APPLYING THE RADIO RANGE FINDER TO ENGINEERING SURVEYS
A. A. Karlson and F. S. Vorona Jan. 1969 9 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 1, 1967 p 16–18
(AD-681961; FSTC-HT-23-668-68) Avail: CFSTI CSCL 8/2

The experience of the Kuybyshev branch of Gidroprojekt in the laying of traverse lines using a radio range finder is summarized. The precision of this method was comparable to that

of analytical polygonometry. Under certain conditions, only two observations were required for measurements. The proposed method is more economical than the polygonometric method. Author (TAB)

N69-21844# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A HIGH-ROTATION GENERAL CIRCULATION MODEL EXPERIMENT WITH CYCLIC TIME CHANGES
Russell L. Elsberry (Ph.D. Thesis) Dec. 1968 116 p refs *Its* Paper No. 134
(Contract N00014-67-A-0299; Grant E-22-138-67(G))
(AD-681744) Avail: CFSTI CSCL 4/1

The phenomenon of vacillation in a rotating annulus is studied as a possible analogue for the atmospheric index cycle. With a simple distribution of heat sources an effort is made to isolate the essential mechanisms by which a baroclinic fluid system undergoes periodic variations in troughline tilt and vortex growth and decay. Author (TAB)

N69-21846# Auroral Observatory, Tromso (Norway).
REPORT OF THE JOINT SATELLITE STUDIES GROUP, ADDENDUM Final Report
1968 174 p refs Presented at the Ann. Meeting, Oslo, Apr. 1968
(Contract F61052-67-C-0088)
(AD-681451; JSSG-3-Add; AFCRL-68-0539) Avail: CFSTI CSCL 4/1

Contents: Laboratory reports: Satellite scintillation; Total electron content; Long range propagation. TAB

N69-21857# Panametrics, Inc., Waltham, Mass.
RESEARCH IN THE DESIGN, DEVELOPMENT AND CONSTRUCTION OF NON-MAGNETIC SENSORS FOR MAGNETIC FIELD-CHARGED PARTICLE CORRELATION STUDIES Final Report, Nov. 1963-Jun. 1968
Bach Sellers, Frederick A. Hanser, and Jean Luc Hunerwadel Oct. 1968 56 p refs
(Contract AF 19(628)-3896)
(AD-681454; AFCRL-68-0585) Avail: CFSTI CSCL 4/1

The results reported can be divided into three areas: (1) Design, construction and flight on a Javelin rocket of a first generation charged particle detection system, for (a) protons with energy between 0.45 MeV and 1.7 MeV, and (b) electrons between 25 keV and 200 keV. (2) Design and construction of a magnetometer range expander. (3) Design and construction for a Niros rocket of a second generation charged particle detection system for (a) protons between 0.4 and 3 MeV, (b) electrons from less than 0.5 keV to 15 keV and (c) electrons from 15 keV to 200 keV. Using the system described in (1) above, the differential spectrum of electrons with $E > 25$ keV and the integral intensity of protons with $0.45 \text{ MeV} < E < 1.7$ MeV have been measured with a rocket fired into a weak aurora at Fort Churchill, Canada. The electron spectrum was observed to become softer during the flight. A correlation apparently exists between peaks in the electron and proton intensities. Broad peaks in the particle intensity correlate with broad dips in the X component of a ground based magnetometer. The magnetometer record appears to be composed of a broad and symmetrical slow component, and a narrow fast component occuring near the start of the slower component. The measured electron spectra indicate that the fast component was a hard electron precipitation while the slow component resulted from a soft electron precipitation. Measurements with a 30 MHz riometer correlate well with the magnetometer record. Author (TAB)

N69-21942# Hawaii Inst. of Geophysics, Honolulu.
SPECIAL VARIATION OF THE T PHASE
Frederick K. Duennebier Dec. 1968 33 p refs
(Contract Nonr-3748(01); ARPA Order 218-7)
(AD-681737; HIG-68-22) Avail: CFSTI CSCL 8/11

The frequency-time characteristics of the T phase are studied in an effort to isolate the properties of the abyssal T-phase generating mechanism. Early arrivals, or forerunners, are found to have the properties of an abyssally generated T phase. Abyssal T-phase generation is found not to be confined to regions of high latitude where the sofar channel is bounded by the ocean surface, but is found to also occur in southern latitudes where the sofar channel is bounded by a surface channel. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-20724 North Carolina State Univ., Raleigh.
INVESTIGATION OF THE BASIC DESIGN PRINCIPLES OF THE FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER
Larry Herbert Royster (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-13476

The basic design principles of the flextensional underwater acoustic transducer are investigated by developing a mathematical model representation for this type of transducer system, and then establishing the effects that the various geometrical parameters have on the total system performance. The acoustic radiation problem was solved by utilizing the Helmholtz integral for the farfield and nearfield pressure distributions. The mechanical shell vibration problem was simplified by replacing the continuous shell with an analogous framework. The coupled stack wave equation was solved in terms of an arbitrary terminal impedance that simulated the combined impedance of the shell and acoustic radiation impedances. Dissert. Abstr.

N69-20725# Toulouse Univ. (France). Faculté des Sciences.
A CONTRIBUTION TO THE STUDY OF ATTITUDE SENSORS. CONSTRUCTION OF A WIDE FIELD SOLAR SENSOR WITH DIGITAL RESPONSE [CONTRIBUTION A L'ETUDE DES SENSEURS D'ATTITUDE. REALISATION D'UN SENSEUR SOLAIRE A GRAND CHAMP ET A REPONSE NUMERIQUE]
Jean-Claude Marpinard (Ph.D. Thesis) 28 Jun. 1967 107 p refs In FRENCH
Avail: CFSTI

Physical phenomena used as attitude references for satellites and spacecraft are reviewed and their useful ranges are discussed. It is shown that systems based on geomagnetic or infrared measurements can only be used for terrestrial orbits and that inertial navigation is not suitable for long missions. For missions far from the Earth, astronomical references must be used, but solar sensors are adversely affected by the drift of the detection and by light sources others than the sun i.e. albedo. Consequently, scanning solar sensor with a rotating minor and digital output has been designed and is fully described. The addition of a simple logic circuit will ensure a simple changeover from a measuring instrument to a sun tracker. ESRO

N69-20730# Atomics International, Canoga Park, Calif.
DEVELOPMENT OF A SOLID STATE COULISTER Final Report, 30 Jan.–1 Aug. 1968
Stuart Giles Aug. 1968 35 p
(Contract DAAG39-68-C-0025)
(AD-681245) Avail: CFSTI CSCL 19/1

The development program conducted under this contract has resulted in the development of a coulister (electrochemical timing device). It appears that the next phase should be one of developing mass production techniques and quality assurance performance data on large quantities of devices. Author (TAB)

N69-20750 Texas A&M Univ., College Station.
A STUDY OF THE DESIGN PARAMETERS FOR THE MEASUREMENT OF CARBON BY NEUTRON INELASTIC SCATTERING
Lloyd Emery Fite (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-11458

Research efforts to determine the feasibility of a neutron carbon meter using the technique of fast neutron inelastic scattering analysis are discussed. The specific objective is to analyze an iron ore sinter mix containing approximately 6% carbon to within 0.25% carbon in two minutes or less. The evaluation of the feasibility of meeting the above requirements included the investigation of various types of neutron sources, neutron attenuators, scintillation detectors, and sample configurations. The results of the individual experiments are given in detail. The basic finding is that the requirements, as established, cannot be met using neutron inelastic scattering methods. A neutron carbon meter which was developed to analyze an iron ore sinter mix sample containing 10% carbon to within 0.25% carbon in 63 minutes is described. Dissert. Abstr.

N69-20777*# Weston Instruments, Inc., College Park, Md.
DEGRADATION OF MULTIPLIER PHOTOTUBES EXPOSED TO SPATIAL RADIATIONS
M. John Brown, M. S. Bae, and S. Dark Washington NASA Mar. 1969 246 p refs
(CONTRACT NASI-7648)
(NASA-CR-1304) Avail: CFSTI CSCL 09A

The degradation of multiplier phototubes was determined from properties measured in situ during exposure to simulated spatial radiations. A complete analysis of the orbital environments for a specific spacecraft was accomplished to determine operational parameters of a phototube detector. The experimental apparatus was then arranged to provide the spatial environments at real time conditions. Exposure of four identical phototubes was conducted to evaluate the synergistic effect of combined radiations including solar, lunar, and earth irradiances and electron-proton accelerated particle radiations over a seven month period. The phototubes were fabricated for high stability using beryllium copper dynodes in each of fourteen stages and their spectral sensitivity was from 250 to 700 nanometers. Selection of the phototube was based on detector requirements in starmapping from an orbiting spacecraft. Laboratory test results indicate that the phototube is relatively stable when exposed to single radiation sources of solar and charged particles, but degrades when exposed to combined radiations, especially when the irradiation profile included lunar viewing. Author

N69-20804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PIEZOELECTRIC PRESSURE TRANSDUCER
M. V. Gusev and O. I. Luneva Mar. 1968 17 p refs Transl. into ENGLISH from Issled. Po Fiz. Gazodin. (Moscow), 1966 p 210–217
(AD-681395; FTD-HT-23-208-68) Avail: CFSTI CSCL 14/2

The design, development, calibration, and performance of a piezoelectric pressure transducer for aerodynamic pressure measurements in shock tubes is described in detail. The sensitive element (diameter--4mm; length--2mm), made of TsTS-19 ceramic, is said to be more sensitive than that made of barium titanate ceramic. The wave guide is made of L-59 brass which has an acoustic resistance close to that of ceramic of the sensitive element. A schematic view of the transducer is given. Author (TAB)

N69-20843# Phaostron Instrument and Electronic Co., South Pasadena, Calif.
ONE PERCENT ACCURACY, 40 AND 100 MICROAMPERE RUGGEDIZED TAUT BAND PANEL METERS (5 1/2 INCHES TIMES 4 1/2 INCHES) Quarterly Report, 1 Aug.–31 Oct. 1968
Norman Logan Nov. 1968 20 p refs
(Contract N00024-67-C-1190)
(AD-679204; QR-4) Avail: CFSTI CSCL 14/2

The report contains development testing of panel meters. The nine were broken down into three groups, each group having a different taut band material. Within each group was one 40 microamp, one 100 microamp, temperature compensated, and one 100 microamp RFI treated. With minor changes to correct problems occurring during thermal shock, moisture resistance and high shock, it is felt all the program requirements will be met except linearity. Temperature compensation has been finalized, the change is expected to vary from 0 to 1% for the 100 microamp units and from 0 to 2% for the 40 microamp units at the various test temperatures. A series of RFI tests has indicated that metal mesh windows provide more attenuation than conductive windows. Author (TAB)

N69-20846# New Zealand. Dept. of Scientific and Industrial Research, Wellington. Physics and Engineering Lab.
OBSERVATION OF FLARE IN LENSES
R. F. Browne Sep. 1968 6 p ref
(DSIR-TN-337) Avail: CFSTI

A method of observing sources of flare (scattered light) in lenses is described. The theory of the system is briefly examined, and an experimental arrangement is described. Author (ESRO)

N69-20857# Columbia Univ., Dobbs Ferry, N. Y. Hudson Labs.
A FALLING-PARTICLE CURRENT METER
T. E. Pochapsky May 1968 25 p
(Contract Nonr-266(84))
(AD-679195; CU-179-68-ONR-266-PHYS; TR-151) Avail: CFSTI CSCL 8/3

Small dense spheres sink in water with a predictable velocity. A horizontal current deflects the path of sinking and the magnitude of the current can be determined from the horizontal deflection. This procedure can be used to measure very small currents, particularly those below 1 cm/sec, which are too small to operate most current meters. A meter built to operate on this principle at sea is described. Author (TAB)

N69-20874*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRONIC POSITION INDICATOR FOR LATCHING SOLENOID VALVES
Robert J. Frye and Heinz L. Wimmer Washington Mar. 1969 9 p refs
(NASA-TM-X-1760) Avail: CFSTI CSCL 09A

The design and operation of an electronic position indicator for a double-latching solenoid valve are presented. Valve stem position in the solenoid coils is detected by sensing the resistive

component of the coil impedance. Four units utilizing this principle have operated successfully for over 1400 hours in a test facility. Author

N69-20941*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE DESIGN AND UNCERTAINTY ANALYSIS OF AN IMPROVED TOTAL HEMISPHERICAL EMITTANCE TRANSIENT CALORIMETER
William R. Wade and Donald J. Progar Washington Mar. 1969 21 p refs
(NASA-TN-D-5106) Avail: CFSTI CSCL 14B

This paper presents the design, the uncertainty analysis, and the test results for several selected materials of a transient calorimetric apparatus for measurement of the total hemispherical emittance of materials for a temperature range from 223° K to 523° K. The uncertainties of the system define the type and magnitude of systematic errors when the calorimetric method of measuring emittance is utilized. The design details which minimize or eliminate these errors are emphasized in the description of the system design. Maximum probable uncertainty has been determined for this system and the results of test runs on highly polished samples of copper and aluminum compare favorably with values of total emittance published by other investigators. Author

N69-20949 Washington Univ., Seattle.
THE DIRECTIONAL SENSITIVITY OF A HOT-FILM ANEMOMETER IN MERCURY
James Christian Hill (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-12693

Steady state calibrations for speed and directional sensitivity of hot-film probes in a liquid metal were made by towing commercially available probes through a pool of mercury at speeds from 0.4 to 1.85 fps and at angles from 0 to 65°. Of the free-stream velocity component parallel to the axis of the cylinder, that fraction κ which contributes to the effective cooling velocity was calculated from smoothed calibration curves. No systematic dependence of inclination on κ was observed. Values of κ at 45° ranged from 0.9 to 0.3 and generally decreased with increasing speed, which is explained with the hypothesis that the thermal inertia of a large thermal boundary layer is responsible for convection by the axial velocity component. A similar but less complete calibration was performed in water for comparison. Dissert. Abstr.

N69-21048# Weather Bureau, Silver Spring, Md.
REMOTE READOUT PANEL FOR A DIGITAL PRECIPITATION GAGE
Francis V. Kohl Mar. 1969 18 p refs
(WBTM-EDL-9) Avail: Issuing Activity

The design, development, and operation of a remote indicator are described for use with digital recording precipitation gages used by the Weather Bureau. The unit presents the gage reading on a set of coded display lamps. A summary of tests and evaluations made on the unit is included. Author

N69-21088*# Barringer Research, Ltd., Rexdale (Ontario).
THE FEASIBILITY OF DETECTION AND CLASSIFICATION OF FISH OIL SLICKS BY REMOTE SENSING Final Report
Feb. 1968 67 p refs
(Contract NASw-1642)
(NASA-CR-100466; TR-68-54) Avail: CFSTI CSCL 17E

The feasibility of detecting and classifying fish and mineral oil slicks on the surface of the ocean is discussed. Investigations of ultraviolet optical properties of the oils and oil films were carried out to determine the feasibility of remote sensing of the oils from a spacecraft platform and to determine if the ultra-violet properties of the oils could be used as a means of detecting and monitoring the areas of high fish oil slick activity which in turn would indicate the location of the large fish schools. Author

N69-21071# Laboratoire de Recherches Balistiques et Aérodynamiques, Vernon (France).
ACCEPTANCE TESTS FOR THREE DIGITAL DIVIDERS No. 665029, 704064, and 719741 [ESSAIS DE RECETTE DES TROIS DIVISEURS DIGITAUX NO.665029, 704064, 719741]
[1968] 38 p In FRENCH
(Contract 68/184/DTEN)
(LRBA-E-510-PV-10/SEV/SI) Avail: CFSTI

The results of acceptance tests for three digital dividers manufactured by Laitz are given. The verticality of the spindle was measured by means of an electronic clinometer in two positions after a rotation of 180° and the error on the accuracy of measurement was also evaluated. The accuracy of ± 1 second of arc claimed by the manufacturer was confirmed. ESRO

N69-21117*# Raytheon Co., Sudbury, Mass.
SPACE GEODESY ALTIMETRY STUDY
Myer Kolker and Ephraim Weiss Washington NASA Mar. 1969 350 p refs
(CONTRACT NASw-1709)
(NASA-CR-1298; R68-4459) Avail: CFSTI CSCL 17G

Performed was a tradeoff analysis of radar and laser space altimetry systems operating in the 1971-1972 time period over the sea surface for providing useful geodetic data. User requirements in the field of geodesy are translated into altimetry performance requirements. These are used as requirement specifications for the design of a candidate laser altimeter system and a candidate radar altimeter system. A tradeoff analysis comparing the two candidate systems results in the selection of the candidate radar altimeter system. Author

N69-21145# Weather Bureau, Sterling, Va.
TRANSMISSOMETER CALIBRATION TECHNIQUES Final Report
Fredrick C. Hochreiter and Robert J. McCann Sep. 1968 140 p refs Prepared for Dept. of Transportation
(Order FA-65-WAI-96)
(RD-68-51) Avail: Issuing Activity

The investigation, analysis, and specification of transmissometer procedures and techniques which may be accomplished without the need of specialized calibration devices are discussed. Two side-by-side, 250-ft. baseline transmissometers are used to isolate calibration techniques that may be useful under all visibility conditions. Preventive maintenance procedures which may be used to minimize transmissometer outages are discussed. The results of a transmissometer maintenance survey are presented. Other results show that it is not possible to calibrate a transmissometer by using data from a nearby system on an airfield. Author

N69-21171# Road Research Lab., Crowthorne (England).
AN AUTOMATIC EVT VISCOMETER
A. J. Codling 1968 18 p refs
(PB-182134; PBL-LR-211) Avail: CFSTI CSCL 14B

The equi-viscous temperature (e.v.t.) viscometer, used to determine the viscosity of road tar has been automated. This has been achieved by using a reversible motor in combination with a constant sequence timer to twist the torsion head. When the tar reaches the equi-viscous temperature a stud fixed to the fly-wheel makes electrical contact with a fixed pointer, thereby activating a buzzer and breaking all other electrical circuits. No loss in accuracy is caused by automation. Disposable plastic tar cups can be used as an alternative to the standard metal cup without affecting the

precision of the instrument. Instead of using a standard tar, silicone fluid which has a much superior storage stability can be used to calibrate the viscometer. Author (USGRDR)

N69-21230# Regional Planning Council, Baltimore, Md.
AERIAL PHOTOGRAPHIC INTERPRETATION AND LAND USE CLASSIFICATION
A. P. Gwynn Apr. 1968 60 p refs Supported by the Dept. of Housing and Urban Develop.
(PB-182117) Avail: CFSTI CSCL 14E

Aerial photographs provide a rapid and relatively accurate means of developing and maintaining a regional land use inventory. Advantages of the system are speed and accurate size, density, and general coverage measurement. Disadvantages are the need for proper photography and trained personnel, and inability to identify all types of land uses to the same level of accuracy. A preliminary land use classification was developed and compared to the 'Standard Land Use Coding Manual' developed by the Urban Renewal Administration and the Bureau of Public Roads. (USGRDR)

N69-21281 Stanford Univ., Calif.
THE STABILITY AND CONTROL OF THE PRINCIPAL AXES OF INERTIA OF ALMOST SPHERICAL BODIES
Howard Lindsay McKinley, Jr. (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-11322

Expressions are given for the outputs of a two-axis autocollimator viewing an optical flat placed near the axis of maximum inertia of a spinning, nearly spherical, free gyro rotor. These output expressions are used to synthesize control laws which perform similar to D-pattern active damping. It is also shown that additional state information, not present in the D-pattern readout signal, is contained in the autocollimator signals and can allow a significant improvement in damping dynamics within the linear region of operation. Optimal control techniques are applied to minimize the amount of surface damage occurring to a rotor during this process. Experimental verification of the operation of one of these control laws is given wherein initial principal axis misalignments of 600 to 800 arc seconds are consistently reduced to 1 to 2 arc seconds. Dissert. Abstr.

N69-21335# Comitato Nazionale per l' Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
NEW TYPE OF ASSEMBLY FOR FABRY-PEROT INTERFEROMETERS
G. Benedetti-Michelangeli and A. Cecchini Jun. 1968 10 p refs Sponsored in part by EURATOM
(LGI-68-20) Avail: CFSTI

A Fabry-Perot interferometer, without fixed spacers, having mechanical characteristics such as to obtain free spectral ranges up to 1000 Å and with axial dimensions reduced, was realized. The precision and sensitivity of the controls allow the adjusting of the spacing ± 1/20 λ. Author (ESRO)

N69-21363*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPARATUS FOR MEASURING SWELLING CHARACTERISTICS OF MEMBRANES
Thomas J. Hennigan Issued 7 Jan. 1969 (Filed 9 Aug. 1965) 6 p Cl. 428491
(NASA-CASE-XGS-03865; US-Patent-3,419,984; US-Patent-Appl-SN-283456) Avail: US Patent Office

A structure for measuring the expansion of a dry electrode-membrane battery assembly when subjected to and immersed in an electrolyte includes a chamber of two compartments separated by a flexible elastomeric membrane, the first compartment for retaining the assembly to be measured on a stationary member and the second compartment containing a movable pressure plate and a resilient member attached thereto for maintaining contact by the pressure plate against the sample which is in turn located on the base member. A micrometer probe is positioned such that it engages the surface of the pressure plate and measures its deplacement. Official Gazette of the U.S. Patent Office

N69-21378 Illinois Univ., Urbana.
A SELECTIVE GAS-CHROMATOGRAPHIC DETECTOR UTILIZING EMITTED RADIATION FROM A SENSITIZED FLAME
Anthony Victor Nowak (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-12174

Both increases or decreases in 589 mμ sodium emission may be observed upon the introduction of a halogen-containing compound to the flame. The hydrogen flow rate is the most important factor which determines whether increases or decreases in emission are observed. Since only halogen-containing compounds appreciably affect the 589 mμ radiation whereas ionization currents for nonhalogen-containing compounds remain unaffected by the presence of the salt-coated probe, a much greater selectivity can be obtained with the photometric system. The photometric detection mode seems capable of greater sensitivity than is possible by measuring ionization currents. Indirect electrical heating of the salt-coated probe and geometrical considerations have provided an increase in stability of measured response. Dissert. Abstr.

N69-21385*# Goodyear Aerospace Corp., Akron, Ohio
THE MODIFICATION AND USE OF A GROUND-BASED PHOTOMETER FOR EVALUATION OF SATELLITE MATERIALS
D. C. Romick, R. H. Emmons, R. J. Preski, and E. D. Kalasky 7 Jun. 1968 116 p refs
(Contract NAS1-6436)
(NASA-CR-66772; GER-13830) Avail: CFSTI CSCL 20F

A cryogenically cooled multipurpose (photometric and polarimetric), five-color (U-B-V-R-I) photometric system was developed. Photometric observations on the Echo 1, PAGEOS 1, Echo 2, and Explorer 19 satellites were performed during four observation periods. The system has been shown to be accurate as well as versatile. Multicolor photometric and polarimetric observations indicate that the aluminized Mylar satellites, Echo 1 and PAGEOS 1, degrade very slowly, if at all, in the space environment. Echo 2 observations performed thus far have shown considerable variations from laboratory measured values for Alodine in air; however, the meaning of this is not yet clear. V-band observations performed on the Explorer 19 satellite indicate that the present optical and physical properties are close to prelaunch design values. The information contained in the Explorer 19 observational data on spin rate and other characteristics attest to the potential capability of the described. Author

N69-21395# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.
A MAGNET CURRENT STABILIZER AND SCANNER FOR THE CEC MODEL 21-110 MASS SPECTROMETER
M. J. Mol 1968 33 p
(EUR-4183.E) Avail: CFSTI

The solid state magnet current stabilizer and scanner described delivers an adjustable current from 0.25 to 5A to the deflection magnet of a mass spectrometer. Its current stability is better than 6 ppm/2 hours as required for the photographic recording of high resolution mass-spectra. The scan circuit provides purely exponential scanning in both the upward and downward direction with time constants selectable from 3.5 to 29,000 seconds to cover a wide range of scan speeds. Furthermore, cyclic scanning by repetitive small linear variations in magnet current is possible. Author

N69-21408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE RESOLUTION AND IMAGE INTENSITY OF THE FIELD-ION MICROSCOPE
Victor G. Weizer and Americo F. Forestieri Washington Mar. 1969 15 p refs
(NASA-TN-D-5125) Avail: CFSTI CSCL 14B

The voltage required to produce blurring of a field-ion image spot was measured as a function of tip temperature. The results indicate that the ion current causing the blurring originates at an adsorbed phase on the surface, and a transit time blurring mechanism operates at low temperatures, whereas at higher temperatures an orbit time blurring mechanism best explains the data. The explanation of the failure of the plane in tungsten to image successfully above 5K is shown to lie in the imaging process itself, not in the action of the blurring mechanisms. Maximum resolution was obtained at 5 K, not at 21 K as generally believed. A method of image intensification is described that has advantages over other existing methods. Author

N69-21452# Adviesbureau Der Genie, The Hague (Netherlands).
The 8th INTERNATIONAL CONGRESS "HIGH-SPEED PHOTOGRAPHY" [HET 8f INTERNATIONALE CONGRES "HIGH-SPEED PHOTOGRAPHY"]
R. W. Trense Jul. 1968 9 p In DUTCH Meeting held at Stockholm, 23–29 Jun. 1968 *Its* Verslag NR. 197
(TDCK-51859III) Avail: CFSTI

Papers presented at the meeting are briefly assessed. The papers covered various aspects of photographic equipment and applications, including image converters, the Cranz–Schardin camera, spark photography, spectrophotography, laser applications, Kerr cells, holography, schlieren photography, interferometry, and TV cinematography. Transl. by K.W.

N69-21513# Harry Diamond Labs., Washington, D. C.
AN AUTOMATIC STEP-AND-REPEAT CAMERA
R. B. Beams, Jr. and C. H. Klute Nov. 1968 40 p
(AD-682068; HDC-TR-1417) Avail: Issuing Activity CSCL 14/5

The report describes an automatic step-and-repeat camera for integrated circuit fabrication. This step-and repeat camera has a continuously variable reduction ratio with final size and focus directly controlled in the camera. Any angular misalignment of the image is corrected without external instrumentation. The control system and other associated components were chosen to minimize cost. The camera is adequate for research laboratory where problems of high rate of mask production are not encountered. It is capable of handling 1/4-mil dimensions as they appear in silicon integrated microcircuits. Author (TAB)

N69-21541* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRESSURE VARIABLE CAPACITOR
Royal G. Harrison, Jr., inventor (to NASA) Issued 14 Jan. 1969 (Filed 17 May 1967) 8 p Cl. 317-246
(NASA-CASE-XNP-09752; US-Patent-3,422,324; US-Patent-Appl-SN-640460) Avail: US Patent Office

A pressure sensing apparatus and the fabrication process is described that provides a unique electrical capacitor assembly which may be incorporated into a tank circuit of a telemetry oscillator that provides wireless remote pressure sensing device. The capacitor assembly includes two body members, one of which constitute a capacitive plate of the capacitor. A beryllium–copper diaphragm, which is the other capacitive plate, is securely attached between the two body members and the body members are firmly sealed to each other by means of an epoxy potting material. Official Gazette of the U.S. Patent Office

N69-21554# Battelle Memorial Inst., Columbus, Ohio.
SURFACE INITIATED FAILURE OF MATERIALS Final Research Report, 1 Feb. 1968–31 Jan. 1969
Ronald D. Gratz 31 Jan. 1969 14 p
(Contract N00014-68-C-0314)
(AD-681856) Avail: CFSTI CSCL 11/6

A feasibility study of the use of a one dimensional field emission microscope for the study of surface initiated failure of materials was conducted. This study demonstrated that more development is needed before such a microscope can be generally used as a non-destructive testing tool. Author (TAB)

N69-21661*# Canaveral Council of Technical Societies, Fla.
THE IMPACT OF BIOSCIENCES REQUIREMENTS ON BIOSATELLITE ATTITUDE CONTROL
J. D. Carpenter (GE, Phila., Pa.), E. T. Thomas (GE, Phila., Pa.), and J. C. Van Ess (NASA, Ames Res. Center) 26 Feb. 1969 24 p refs
(Contract NAS2-1900)
(NASA-CR-73291) Avail: CFSTI CSCL 22B

The design, development, and flight test results of the Biosatellite attitude control system are discussed. Preliminary remarks describing the several Biosatellite missions show how mission constraints were interpreted by the controls engineer and how the zero–g and recovery requirements were ultimately translated into attitude control performance criteria. Results of analyses of payload perturbing effects are presented. Also included is a discussion on the prominent role a continuing simulation activity played in the development of the attitude control system. Of particular interest to the controls oriented engineer is the discussion stressing the importance of these simulation studies to the analysis and evaluation of control system performance in the deorbit phase of the mission. Author

N69-21692# Harry Diamond Labs., Washington, D. C.
PIEZOELECTRIC ACCELEROMETER INSTRUMENTATION FOR GAS GUNS
Ira Smith Oct. 1968 27 p refs
(AD-681886; HDL-TM-68-29) Avail: CFSTI CSCL 14/2

The report summarizes work done to use piezoelectric accelerometer instrumentation and trailing-wire techniques in an air-gun application. The work was done in three phases: (1) conversion of normally low-velocity drop shock instrumentation to air guns; (2) application of this system in determining peak and average deceleration levels as well as time duration of various shock pulses; (3) compilation of data for an air-gun system to use in production testing. The advantages and disadvantages of the instrumentation are presented, as well as a detailed test procedure. Particular attention is given to the data obtained from phase 3. The shock phenomena are shown which could not have been obtained with previous instrumentation. Author (TAB)

N69-21697*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE CELESCOPE EXPERIMENT
R. J. Davis, ed. 18 Jul. 1968 155 p refs
(Contract NAS5-1535)
(NASA-CR-100522); SAO-Special-Rept-282) Avail: CFSTI 17H

The capabilities and limitations of the celescope are described. It was installed in the Orbiting Astronomical Observatory Spacecraft No. A-2 for orbiting the earth at 800-km altitude. The television camera tube face plate was designed with the engineering constraint that it is transparent to the radiation being measured. Since lithium fluoride was used for the faceplate, the transparency limits observations to above 1050 Å. It is designed to measure 25,000 main-sequence stars in four bands between 1000 and 3000 Å, and to serve as forerunner for future, more-specialized satellites. Details of calibration, and instrumentation are included. F.O.S.

N69-21743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EQUIPMENT AND METHODS OF MEASUREMENT USED IN AIRCRAFT FLIGHT TESTING
A. V. Pavlov Jul. 1968 287 p refs Transl. into ENGLISH of the book "Apparatura i Metody Izmerenii Pri Letnykh Ispytaniyakh Samoletov" Moscow, 1967 p 1-215
(AD-681668; FTD-MT-24-74-68) Avail: CFSTI CSCL 1/3

Chapter I of the book contains general information about measuring equipment, about errors in measurements, and an appraisal of the accuracy of instruments is given. Chapter II covers different types of converters. In Chapters III-VIII are examined basic types of measuring equipment: for pressure, speed, barometric altitude, angular and linear displacement, deformation, force, overload, vibration, angles of turn, angular velocity, angular acceleration, fuel consumption, and temperature. In Chapters IX-XI are described airborne and ground recorders, and basic errors of methods of recording by magnetic recorders, telemetry equipment, and instruments operating on carrier frequency are given. In Chapter XII presented basic measuring circuits used during flight tests, and methods of their design are given. In the last chapter are given the simplest methods of processing readings of self-recordings instruments and oscillograms. Author (TAB)

N69-21818# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF GYROSCOPIC DEVICES, PART 1, VOLUME 2
S. S. Rivkin 10 Dec. 1968 234 p refs Transl. into ENGLISH from Mono. Teoriya Giroskopicheskikh Ustroistv (Leningrad), Chapter 5/6, 1962
(AD-682104; FTD-HT-23-38-68-Vol-2) Avail: CFSTI CSCL 17/7

The theory of gyroscopic devices, part I, volume 2: translation. TAB

N69-21884# Illinois Univ., Urbana. Coll. of Civil Engineering.
ABOUT THE INCORPORATION OF HORIZON PHOTOGRAPHY IN ANALYTICAL AEROTRIANGULATION
W. Weissman Jan. 1968 40 p refs Presented at 11th Intern. Congr. of Photogrammetry, Lausanne, Switz., Jul. 1968 its Civil Eng. Studies, Photogrammetry Seri. no. 18
(GRANT NSF GK-776)
(PB-180783) Avail: CFSTI CSCL 08B

A new method for the determination of the attitude of aerial cameras phi and omega, and under certain conditions, also kappa by means of horizon photography is herein presented. In addition to the resulting tilt components of every photograph, the method provides means of determining the absolute orientation components PHI and OMEGA of each model. These elements are then incorporated in the adjustment of the strip. The strip adjustment takes full advantage of the available auxiliary data as well as any available ground control point and solves simultaneously for all orientation parameters of each model. Author (USGRDR)

N69-21882# Comitato Nazionale per l'Energia Nucleare Frascati (Italy).
A MAGNETIC ANALYZER TO BE USED FOR ADONE COLLIDING BEAM EXPERIMENTS
W. Ash (Princeton Univ.), D. Grossman (Princeton Univ.), G. Matthiae (1st. Super. Di Sanita, Rome), G. P. Murtas, M. Nigro (INFN, Sez. Di Padova) et al 7 Jan. 1969 47 p refs
(LNF-69/2) Avail: CFSTI

A detection apparatus designed to analyze the particles produced in e^+e^- collisions in Adone at energies between .75 and 3.0 GeV is described. Details are given on the magnetic system, external spark chambers, internal spark chambers, trigger counter system, optics, luminosity monitors, electronic equipment, gas control system, straight section, and magnet support frame. Specific considerations are discussed, including magnetic interferences with Adone; acceptances and accuracy of the detection system, with emphasis on spatial, momentum angular, and mass resolution; spark chamber usage; luminosity measurements; and gas control system design. Schematic drawings are included. P.A.B.

N69-21891# National Center for Atmospheric Research, Boulder, Colo.
CONICAL AEROSOL SPECTROMETER; CYLINDRICAL AEROSOL SPECTROMETER
Paul M. Brown and Dietrich Hochrainer 1968 6 p
(Contract NSF C-460)
(PB-180880) Avail: CFSTI CSCL 13B

Detailed descriptions are given of two different designs of airborne aerosol collectors. USGRDR

N69-21923*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROCK DRILL FOR RECOVERING SAMPLES
Allen G. Ford, inventor (to NASA) Issued 14 Jan. 1969 (Filed 27 Dec. 1966) 5 p Cl. 175-323
(NASA-Case-XNP-07478; US Patent 3,421,591; U.S.-Patent-Appl-SN-605097)

A rock drill, comprising a drill rod and surrounding sleeve, is described. The drill rod exterior and surrounding sleeve interior are threaded so that the tips on the rod threads and the tips of the sleeve threads are staggered. The vibratory motion of the rod and sleeve serve to propel rock particles through the annular space between the rod and sleeve and upwardly by reason of the threaded surfaces of the respective rod and sleeve. Official Gazette of the U. S. Patent Office.

N69-21940# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
AN EXPLORATION OF THE POTENTIAL OF P-N JUNCTION DEVICES FOR TRANSDUCER APPLICATIONS Final Report, 1 Sep. 1966-31 Aug. 1968
M. E. Sikorski, R. P. Woodward, L. H. Glassman, and C. K. Kuo Jan. 1969 136 p refs
(Contract N00014-67-A-0159)
(AD-682204; GIT-A-971-F) Avail: CFSTI CSCL 9/1

The purpose of the project was to explore the potential of pn junction devices for transducer applications. In particular, the aim was to generate information that could be used to assess whether this new transducer concept can advance the present state of transducer technology. We have used transistors as sensing elements because of the built-in amplification and a linear relationship that exists between bias voltage V sub CE and pressure. The linear range can be controlled. For transducer action, the stress is applied to the transistor by means of a sharp sapphire indenter. Transistor transducers are characterized by very high sensitivity, excellent frequency response, from dc into the MHz range, and small size. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-20744# Bell Helicopter Co., Fort Worth, Tex.
IMPROVED CONCEPT OF ELASTOMERIC BEARINGS FOR UH-1 TAIL ROTOR ASSEMBLY Final Technical Report
C. H. Fagan Oct. 1968 62 p refs
(Contract DAAJ02-67-C-0076)
(AD-681244; 6SAAVLABS-TR-68-84; REPT-572-099-008) Avail: CFSTI CSCL 1/3

This report presents the results of a research program to extend the state of the art of elastomeric bearings and to investigate further their application on a UH-1 tail rotor. In a previous program (See AD-661 614), Teflon journal bearings were used in conjunction with an elastomeric thrust bearing for carrying the edgewise and flapwise bending moments and for stiffness control. For the subject investigation, the Teflon journal bearings were eliminated. One radial and two thrust bearings were designed and fabricated for the blade grip application. One thrust bearing employed chevron shaped separators, and the other used 45-degree dished sheets between the layers of elastomer. Bench tests were conducted, and two blade grip bearing arrangements were whirl tested. One arrangement used a single chevron thrust bearing, and the second used the 45-degree dished thrust bearing in conjunction with the radial bearing. The tests showed acceptable frequency placement for the radial-thrust bearing arrangement. The chevron arrangement frequency placement was unsatisfactory. Flight tests of the radial-thrust bearing arrangement showed acceptable blade and hub structural loads, which were in most cases comparable to those of the UH-1. Author (TAB)

N69-20767 Houston Univ., Tex.
THEORETICAL AND EXPERIMENTAL ANALYSIS OF VARIABLE PRESSURE FILTRATION AND THE EFFECT OF SIDE WALL FRICTION IN COMPRESSION-PERMEABILITY CELLS
Wei-Ming Lu (Ph.D. Thesis) 1968 234 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 68-11149

Theoretical and experimental studies were made in order to improve insight into the process of cake filtration. The mechanism of variable pressure filtration was analyzed by taking into account the variation of liquid and solid flow rates within the filter cake. Generalized expressions for internal flow rate variations, porosity, and pressure distributions throughout a filter cake were derived. A newly defined correction factor for Ruth's average filtration resistance was developed. A new numerical method for calculating the variation of variables involved in variable pressure filtration is presented. The phenomenon of side wall friction in compression-permeability cells was investigated. Dissert. Abstr.

N69-20938*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION WITH SOME POLYPHENYL ETHERS AND SUPERREFINED MINERAL OILS IN A 600° F (316° C) INERTED VANE PUMP LOOP
William R. Jones, Jr., William F. Hady, and Max A. Swikert Washington Mar. 1969 18 p refs
(NASA-TN-D-5096) Avail: CFSTI CSCL 11H

A vane pump loop was used to determine the lubricating ability as well as thermal and shear degradation of some polyphenyl ethers and superrefined mineral oils. Experimental conditions included 250 psig pump pressure, 425° F (219° C) fluid temperature at the pump inlet, 600° F (316° C) fluid temperature at the heater outlet, 1.73×10^4 in/hr surface velocity and an inert cover gas (nitrogen). Low vane wear was obtained with a 77 centistoke (100° F) (38° C) napthenic mineral oil and two naphthenic-paraffinic blends. Higher wear was obtained with a 15 centistoke (100° F) (38° C) paraffinic mineral oil, a four and a five ring polyphenyl ether, and a modified polyphenyl ether (C-ether). Author

N69-20939*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY INVESTIGATION OF GRAPHITE FLUORIDE $(CF_x)_n$ AS A SOLID LUBRICANT
Robert L. Fusaro and Harold E. Sliney Washington Mar. 1969 20 p refs
(NASA-TN-D-5097) Avail: CFSTI CSCL 11H

Friction and wear life studies were conducted on burnished (rubbed on) films of a potential, new, solid lubricant $(CF_x)_n$. Results were compared with those of similar tests for graphite and MoS_2. The comparisons showed that, at any one specific temperature, the wear lives of $(CF_x)_n$ films exceeded those of graphite or MoS_2. Also, the friction coefficient of $(CF_x)_n$ was less than that of graphite and approximately equal to that of MoS_2. The upper temperature limitation of the $(CF_x)_n$ burnished films is about 400° C. The influence of the fluorine-to-carbon ratio in the compound was investigated and did not seem to be of importance in the range considered (1.12 to 0.7). Author

N69-21002*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
SUPERSONIC TRANSPORT LUBRICATION SYSTEM INVESTIGATION, PHASE 2 Periodical Report
W. L. Rhoads 27 Dec. 1968 75 p refs
(Contract NAS3-6267)
(NASA-CR-72496; AL68T074) Avail: CFSTI CSCL 11H

Ball bearings and face seals for use on Mach 3 aircraft gas turbine engine mainshafts were evaluated in tests of up to 50 hours duration using a recirculating system with jet lubrication under typical engine load and speed conditions with the seals exposed to 1200°F air and to a pressure differential of 100 psi. Three lubricants were evaluated in these tests. Mobile Jet II ester performed adequately at 500°F bearing temperature (400°F oil-in) without inert gas blanketing for 50 hours. Two synthetic hydrocarbon fluids tested with an inert gas blanket (Mobile XRM-109F plus 10% Kendex high molecular weight mineral oil resin, and Mobil XRM-109F plus 10% Kendex resin plus Mobil XRM-127B blended to the same viscosity as XRM-109F) performed well at 650°F bearing temperature (500°F oil-in). The test with the blend of the three fluids ran for the full 50 hours; however, system performance during the other hydrocarbon test was limited by oil seal failure after 32 hours. Author

N69-21102# European Atomic Energy Community, Ispra (Italy) Joint Nuclear Research Center.
SELECTION OF ABRASIVES AND ADDITIVES FOR DECONTAMINATION BY WET ABRASIVE BLASTING [AUSWAHL VON ABRASIVEN UND BADZUSAETZEN FUER DIE DEKONTAMINIERUNG MITTELS SCHLAMMSTRAHLEN]
G. Mosselmans and J. Nienhaus 1968 35 p refs In GERMAN; ENGLISH summary
(EUR-4186.D) Avail: CFSTI

Wet abrasive blasting was investigated as to its decontamination potentials. Different abrasive materials were tested looking for a substance universally applicable. The choice has to be made so that decontamination is as complete as possible while neither the material's surface is damaged nor its adsorption qualities are enhanced. The possibilities of surface passivation are examined using various additives to the liquids used for wet blasting. In order to lessen the viscosity of the abrasive suspension as well as to avoid unwanted agglomerations (sedimentations) different tensides were investigated. Author

N69-21153*# Ion Physics Corp., Burlington, Mass.
IMPROVED SOLAR CELL CONTACTING TECHNIQUES Final Report

R. W. Sudbury and K. A. Stirrup Feb. 1969 45 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952144)
(NASA-CR-100451) Avail: CFSTI CSCL 13H

Aluminum, nickel, and copper contacted solar cells using ion beam sputtering technology are reported. Apparent damage to the cells during contacting and the effect of annealing is reported. Environmental tests were made at high temperature and humidity. Aluminum contacted solar cells were fabricated with greater than 10% AMO efficiency for an uncoverslipped CeO_2 antireflection coated cell. Solderless interconnection of aluminum contacted cells was made by ultrasonic bonding of ribbons that could withstand a 1750 gram pull perpendicular to the solar cell. Author

N69-21235# Saarland Univ., Saarbrucken (West Germany). Institut fuer Werkstofftechnologie und Allgemeine Huettenkunde.
INFLUENCE OF THE RUBBING SPEED ON THE ABRASION OF CARBIDES AND OXIDE SINTERED MATERIALS [EINFLUSS DER GLEITGESCHWINDIGKEIT AUF DEN VERSCHLEISS KARBIDISCHER UND OXIDISCHER SINTERWERKSTOFFE]
W. Dawihl and E. Klingler [1968] 33 p refs In GERMAN; ENGLISH summary Presented at 2d Europaeisches Symp. Ueber Pulvermet., Stuttgart, May 1968
Avail: CFSTI

The wear resistance of cemented carbides and of sintered alumina is given especially by the influence of the speed and its impact resistance. Author

N69-21300# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Aeronautical Engineering and Astronautics.
A STUDY OF EXISTING INFORMATION ON ROTATING STALL, WITH NEW OBSERVATIONS CONCERNING CHANGES IN STALL CELL SIZE AND NUMBER
Michael J. Leone (M.S. Thesis) Sep. 1968 173 p refs
(PB-180939; TR-AE-6810) Avail: CFSTI CSCL 13I

A detailed study of existing information on the phenomenon of rotating stall is presented with the following objectives: (1) to properly assess present understanding of the phenomenon, (2) to use this assessment in establishing realistic goals for future investigations, and (3) to point out certain aspects of existing information which may have gone unnoticed heretofore. Only a limited degree of understanding has been achieved; the basis nature of rotating stall must still be classified as unknown. An observation is made relative to stall-pattern changes and their dependence on the initial values of the parameter measuring the stalled fraction of the cascade. Although the relationships presented are applicable in the strict sense only to two configurations of the same rotor, the discussion does indicate possible new directions for future research. Author (USGRDR)

N69-21315# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut fuer Steuer- und Regeltechnik.
THE TURBINE-TORQUE IN EXTERNALLY PRESSURIZED, AIR LUBRICATED THRUST-BEARINGS [DAS TURBINENMOMENT BEI DRUCKLUFTGESPEISTEN SPURLAGERN]
R. Bahmann (Ph.D. Thesis—Tech. Hochschule, Munchen) Dec. 1968 70 p refs In GERMAN; ENGLISH summary
(DVL-789; DLR-FB-68-82) Avail: CFSTI

Calculation of the turbine torque in externally pressurized, air lubricated thrust bearings by theoretically investigated thumb rules in order to gain regulations for the construction of bearings with a minimum of turbine torque is presented. The results were that turbine torque is created by the following three influences: twisted air flow to the bearing gap, unsymmetrical air flow to the bearing gap, and flaws, scratches or other disproportion on or of the bearing surfaces. For each of those three kinds of turbine torque a thumb rule was developed and experimentally tested. Based upon those thumb rules, design regulations were postulated to facilitate the construction of bearings with a minimum of turbine torque. Finally, the use of metal powder filters instead of orifices was studied. Both theoretically and experimentally the excellent efficiency of these filters proved to be an aid for suppression of the turbine torque. Author

N69-21352*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF COMPRESSOR END SEALS STATOR INTERSTAGE SEALS, AND INTERIOR PIVOT SEALS IN ADVANCED AIR BREATHING PROPULSION SYSTEMS Semiannual Report, 30 Jun.–31 Dec. 1968
R. M. Hawkins and A. H. McKibbin 20 Jan. 1969 50 p
(Contract NAS3-7605)
(NASA-CR-72516; PWA-3597; SAR-7) Avail: CFSTI CSCL 11A

The compressor seal test rig was assembled and tested; modifications were made to correct rig discrepancies. Static testing of floating-shoe compressor seals revealed excessive leakage because of tilting of the shoes; modifications were initiated. Vane pivot seals were evaluated at simulated engine conditions and the bellows type exhibited low leakage rates. Author

N69-21362*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FOIL SEAL
Lawrence P. Ludwig, inventor (to NASA) Issued 14 Jan. 1969 6 p (Filed 20 Apr. 1966) Cl. 277-25
(NASA-Case-XLE-05130; US-Patent-3,421,768; US-Patent-Appl-SN-545224) Avail: US Patent Office

A circular foil disc mounted on a rotating shaft in close proximity with a spirally grooved plate forms a seal. The fluid to be sealed enters a radial gap between the disc and plate, and the movement of the rotating disc relative to the plate creates a pumping action which prevents leakage.
Official Gazette of the U. S. Patent Office

N69-21374# Aktiebolaget Atomenergi, Stockholm (Sweden).
FRICTION FACTORS IN ROUGH ROD BUNDLES ESTIMATED FROM EXPERIMENTS IN PARTIALLY ROUGH ANNULI. EFFECTS OF DISSIMILARITIES IN THE SHEAR STRESS AND TURBULENCE DISTRIBUTIONS
Bjorn Kjellstrom Dec. 1968 28 p refs
(AE-343) Avail: CFSTI

Experiments with rough surface friction and heat transfer are often made in an annulus with rough inner surface and smooth outer surface. Utilization of data from such experiments for calculation of rough rod bundle fuel elements requires a transformation of the data. For this purpose the method of WB Hall is frequently used. The errors introduced by two of the assumptions on which this method is based, namely the assumptions of zero shear at the radius of maximum velocity and the assumption of no turbulence exchange between the subchannels, are discussed, and the magnitude of the errors is estimated on basis of experiments in a partially rough annulus. It is found that the necessary corrections do not amount to more than about + 10% for the friction factor and + 15% for the Reynolds number and the equivalent diameter. The correction for the turbulence exchange alone is of the order of 2-3%. A comparison of friction factors measured in a rough 48-rod bundle and predicted from measurements in a partially rough annulus was also made. The prediction was 5% high instead of about 10% low which could have been expected from the considerations earlier in the report. Explanations for this can be found in the effect of the channel shape or inaccuracies in the rod bundle experiment. Annulus experiments which will allow comparisons with other rod bundle experiments will be run to clarify this. Author (ESRO)

N69-21391# Lockheed Missiles and Space Co., Palo Alto, Calif. Surface Chemistry Materials Sciences Lab.
ACTIVATED CHARCOAL AIR FILTER SYSTEM FOR THE NASA 1973 BASIC SUBSYSTEM MODULE
A. J. Robell, R. P. Merrill (Calif. Univ., Berkeley), and C. R. Arnold Jun. 1968 48 p refs
(LMSC-6-78-21) Avail: Issuing Activity

The design and development of a regenerative sorption system for the removal of trace contaminants, in which regeneration is accomplished by exposure to space vacuum at elevated temperatures, are described. The design includes quantitative estimates on adsorbate interference, vacuum desorption rates, and adsorbate profiles in the sorbent bed. Parametric calculations of charcoal load and pressure drop as functions of flow rate for beds of comparable breakthrough characteristics are discussed, and design limitations are mentioned. Tabular data concerning bed sizing and design, heat transfer calculations, and regeneration temperature estimates are included. P.A.B.

N69-21460*# Virginia Univ., Charlottesville.
DEPOSITING SEMICONDUCTOR FILMS UTILIZING A THERMAL GRADIENT
Robert L. Ramey, inventor (to NASA) Issued 7 Jan. 1969 (Filed 19 Aug. 1966) 3 p Cl. 117-201
(NASA-Case-XKS-04614; US-Patent-3,420,704; US-Patent-Appl-SN-574280) Avail: US Patent Office

A process for increasing the hole mobility of deposited semiconductor material film on a substrate is provided. In a vacuum a polycrystalline semiconducting film such as germanium is deposited onto a substrate while maintaining a thermal gradient across the substrate. Official Gazette of the U. S. Patent Office

N69-21465*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONDENSER: SEPARATOR
Franklin W. Booth, inventor (to NASA) Issued 7 Jan. 1969 (Filed 1 May 1967) 5 p Cl. 62-93
(NASA-Case-XLA-08645; US-Patent-3,420,069; US-Patent-Appl-SN-635970) Avail: US Patent Office

A condenser-separator for dehumidifying air utilizes a sintered metal surface separating a humid air stream from a coolant media of the same liquid as the condensate is taken from the airstream. A system utilizes a coolant chamber having an outer surface made of sintered metal and the interior connected to the suction side of a pump. Coolant, including condensate, passes a constant pressure valve into a reservoir from which it is drawn for recirculation and cooling of the interior of the sintered metal surfaces. Official Gazette of the U.S. Patent Office

N69-21471*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
PRETREATMENT METHOD FOR ANTI-WETTABLE MATERIALS
Clyde M. Adams, Jr. and Stanley Weiss, inventors (to NASA) Issued 7 Jan. 1969 (Filed 30 Jun. 1963) 7 p Cl. 219-121
(NASA-Case-XMS-03537; US-Patent-3,420,978; US-Patent-Appl-SN-468655) Avail: US Patent Office

Brazing processes may be conducted on materials having difficult-to-wet surface characteristics such as beryllium by initially treating the surface to be brazed with a vapor deposited coating of titanium or zirconium, approximately two to five microns thickness, applied in a vacuum environment. Subsequently, any appropriate braze filler such as aluminum may be used, also in a vacuum to complete the braze joint. Official Gazette of the U. S. Patent Office

N69-21472*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TUMBLER SYSTEM TO PROVIDE RANDOM MOTION
George A. Rinard and John D. Watson, inventors (to NASA) Issued 7 Jan. 1969 (Filed 14 Sep. 1965) 6 p Cl. 317-157.5
(NASA-Case-XGS-02437; US-Patent-3,421,053; US-Patent-Appl-SN-487344) Avail: US Patent Office

A tumbling apparatus is described having three rotating mutually perpendicular frames, each frame being driven from the drive shaft of the outermost frame. Objects to be demagnetized are positioned on the innermost frame within a slowly varying ac magnetic field, with field amplitude being controllable so that reduction of the amplitude of the field occurs while the objects to be demagnetized tumble throughout resulting in removal of remanent magnetization. Official Gazette of the U.S. Patent Office

N69-21522# National Physical Lab., Teddington (England). Aerodynamics Div.
A NOVEL DESIGN OF RELIEF VALVE FOR THE PROTECTION OF SENSITIVE INSTRUMENTS IN PNEUMATIC SYSTEMS
M. J. Larcombe 7 Jun. 1968 13 p
(NPL-Aero-1069; ARC-30288) Copyright. Avail: CFSTI

A description is given of a relief valve for protecting instruments designed for operation at sub-atmospheric pressures. The valve ensures that an instrument is not subjected to a pressure greater than one atmosphere even though an overpressure may be in excess of 20 atmospheres. The performance of the valve, particularly during the process of valve opening, is demonstrated by experimental measurements. Author (ESRO)

N69-21553# Army Foreign Science and Technology Center, Washington, D. C.
MODERN ENGRAVING MATERIALS
V. N. Filin Jan. 1969 12 p Transl. into ENGLISH from Geodez. i Kartograf. (Warsaw), no. 7, 1968 p 71–76
(AD-681962; FSTC-HT-23-670-68) Avail: CFSTI CSCL 14/5

Various types of engraving substrate materials are comparatively evaluated, and it is concluded that: (1) temperature control is more important to precise plate dimensions than is humidity control; (2) polyesters have better deformation properties than polyvinyl chlorides; (3) glass which has the best deformation properties, does not allow direct engraving from an underlaid original and copying through the substrate. Author (TAB)

N69-21588# Adviesbureau Der Genie, The Hague (Netherlands).
STUDY OF THE DOUBLE-ACTION, SELF-CLOSING AIR VALVE OF THE ADVIESBUREAU DER GENIE [ONDERZOEK BETREFFENDE DE DUBBELWERKENDE ZELFSLUITENDE LUCHTKLEP VAN HET ADVIES BUREAU DER GENIE]
P. W. P. H. Ludwig 22 Jul. 1968 29 p In DUTCH
(REPT-195; TDCK-51344) Avail: CFSTI

This simple valve was designed to protect air ventilation systems of air raid shelters against shock waves caused by nuclear explosions. The valve consists of a sliding plate mounted between two coil springs on a central axis. The plate is forced into the opening or closing position by the pressure. In tests it was established that the valve has a capacity of 3000 m^3 of air per hour without being closed by the resulting pressure difference. The strength of the valve to withstand interior and exterior pressures and the forces required for opening and closing the valve were calculated. Transl. by K.W.

N69-21645# Harry Diamond Labs., Washington, D. C.
THIN-FILM ELECTRIC INITIATOR. 1: FABRICATION OF Cu/Ni BRIDGES

Emma Lee Habb Nov. 1968 29 p refs
(AD-681888; HDL-TR-1412) Avail: CFSTI CSCL 19/1

The production of a low-cost thin-film electric initiator for fuze detonators was shown to be feasible; early experiments used chemically deposited nickel-phosphorus alloy as the resistor bridge and copper as the conductor. A polyimide film is the best plastic substrate found to date. Bridges having resistances of 6 to 7 ohms, produced on polyimide film, were reproducible and had good stability. Author (TAB)

N69-21696# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PULSE-ARC WELDING OF ALUMINUM ALLOY

A. G. Potapevskii et al 15 May 1968 54 p Transl. into ENGLISH from Impulsno-Dugovaya Svarka Alymin. Splavov (Leningrad), 1968 p 1–45
(AD-681600; FTD-MT-24-23-68) Avail: CFSTI CSCL 13/8

The article describes in detail the process of pulse-arc welding of aluminum alloys in the presence of argon as a shielding gas. Parameters of the process are specified. Equipment for a typical welding station is described. It is suggested that regular automatic and semi-automatic machines can be used with only minor modifications, mainly to achieve better feed of the consumable electrode. Sections of the article are devoted to the practice and technique of forming welded seams in various attitudes. Types of electrode wire and care in its storage and use are outlined. The control of parameters of welding is emphasized. Particular attention is devoted to use of the process in the building of ship superstructures. Advantages of the pulse-arc method over customary methods are listed together with a cost comparison of various types of welding. Author (TAB)

N69-21699 British Hydromechanics Research Association, Cranfield (England).

EVALUATION OF AN OIL HYDRAULIC PIPE COUPLING

A. Crook Glasgow Natl. Eng. Lab. Aug. 1968 46 p refs Prepared jointly with National Eng. Lab., Glasgow
(BHRA-NEL-Joint-Rept-4) Copyright. Avail: CFSTI

Performance tests conducted at maximum and minimum tolerance conditions are described. The program included very high pressure static, high pressure impulse, and vacuum tests at normal, 50°, and –40°C temperatures. A preliminary investigation was necessary to define the tightening conditions for the couplings at the high static pressures (about 23,200 lb/in^2, 1600 bar). The couplings passed most of the tests with only minor damage to some of the O rings. However, after the impulse tests at –40°C, the O rings were found to be extruded into the threads of the coupling; an explanation for the cause of the condition is proposed. Notwithstanding the above damage, performance of the couplings was considered to be satisfactory, and it was concluded that they fulfill the purpose for which they were designed despite occasional malfunctions. Author

N69-21708*# Metaalinstituut TNO, Delft (Netherlands).

HOT PHOSPHATE STUDY. PART 7: RINSING AS PART OF THE PHOSPHATING PROCESS [SPEURWERK WARM FOSFATEREN. DEEL VII: DE UITVOERING VAN DE SPOELBEHANDELING IN DE FOSFATEERREEKS]

24 Dec. 1968 30 p refs In DUTCH
(M68-971; TDCK-52570) Avail: CFSTI

In general, the phosphating study is concerned with the surface protection of relatively small steel parts. In this paper a theoretical approximation of the rinsing process was worked out in which calculation methods were derived for design and operation of the rinsing bath. The applicability of the theoretical results was verified in several tests. Loss of solution, replenishment, concentration, impurities, design of the bath apparatus, and material requirements are examined. Transl. by K.W.

N69-21741# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DESIGNING A LIGHT-GAS GUN WITH LIGHT PISTON

S. N. Palkin et al Jul. 1968 23 p refs Transl. into ENGLISH from the book "Aerofizicheskiya Issledovaniya Sverkhzvukovyk Technenii" Moscow, 1967 p 210–218
(AD-681691; FTD-MT-24-238-68) Avail: CFSTI CSCL 14/2

The article concerns a method for and results of analysis of light-gas gun with light piston, founded on successive calculation of parameters of separate elements of the device. Calculation of piston and model speeds are carried out for three types of outflow from combustion and compression chambers: combined, nonstationary with allowance for, and nonstationary without allowance for inequality of chambers and barrel. Author (TAB)

N69-21751# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PNEUMATIC CONTROL MACHINE FOR AUTOMATION OF POLYETHYLENE PRODUCTION

B. V. Volter et al Aug. 1968 12 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 6, 1967 p 29–31
(AD-681807; FTD-MT-24-260-68) Avail: CFSTI CSCL 7/1

A pneumatic control computer for use in automatic polyethylene production is described. Ethylene under 1500 atm pressure is used as a raw material. Polymerization takes place in the reactor at 200--250C with a small quantity of initiator. The polymer and gas residues formed are subsequently channeled into a separator unit, where polymer and ethylene being returned to the reactor are extracted. The control computer (auto-operator) regulates all process parameters, implements process control logic, starts and stops the control process, and has emergency protective features. The computer uses approximately 360 analog and discrete pneumatic elements. Deviation of basic parameters beyond their allowable operating range is indicated on the control panel, which also contains a temperature signal panel indicating reactor temperature distribution. Two polymerization processes may be controlled by such a machine. The basic characteristics are: input and output signals are compressed air (0.2 - 1 atm) and electrical relay signal 70 pneumatic and 25 electrical input signals, 30 output signals, are available, the temperature signal panel contains 12 points corresponding to different temperatures. The machine measures 1.7 x 1.7 x 1.7 m. During four years of use, only 35 pneumatic elements needed replacement, which supports the assertion of a high reliability index. Author (TAB)

N69-21772*# Mechanical Technology, Inc., Latham, N. Y.

HIGH-PERFORMANCE TURBOALTERNATOR AND ASSOCIATED HARDWARE. 2: DESIGN OF GAS BEARINGS

A. Frost, J. W. Lund, and P. W. Curwen Washington NASA Mar. 1969 349 p refs Prepared for Pratt and Whitney Aircraft, East Hartford, Conn.
(Contract NAS3-6013)
(NASA-CR-1291; MTI-67TR29; PWA-3070-Vol-2) Avail: CFSTI CSCL 13I

The National Aeronautics and Space Administration is conducting an evaluation of Brayton cycle turbomachinery configurations. As part of this program, a turboalternator incorporating a two stage axial-flow turbine driving an inductor alternator supported on gas bearings has been designed. The gas bearings were designed and successfully tested in a gas bearing dynamic simulator. Testing of the simulator under full electrical load and under certain electrical fault conditions indicated satisfactory operation of the rotor system. Author

N69-21833# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABRASIVE WEAR RESISTANCE OF CONSTRUCTIONAL MATERIALS AND MACHINE PARTS

M. M. Tenenbaum. Aug. 1968. 421 p. refs. Transl. into ENGLISH of the book "Iznosostoikost Konstruktsionnykh Materialov Detalei Mashin Pri Abrazivnom Iznashivanii" Moscow, Nauka, 1966. p. 1–331
(AD-682112; FTD-MT-24-133-68) Avail: CFSTI CSCL 13/9

The book deals with theoretical and applied problems of the wear resistance of materials and machine parts. Main attention is devoted to abrasive wear which shortens the service life of agricultural, mining, construction, and other machines and industrial equipment. The important problem of prolonging the service life of machine parts, in particular under extreme conditions (such as high temperatures or in contact with molten metals), is discussed. It is stressed that premature wearing away of machine parts is often the result of defective design or the wrong choice of materials. Testing techniques for wear resistance under various conditions of abrasive wear are discussed. Data are provided on the wear resistance of various materials, including plastics. General problems of the reliability and durability of machines in connection with the service life of machine parts are set forth. Author (TAB)

N69-21854*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HAND CUTTER AND SEALER FOR FUSIBLE FABRICS
Robert J. Carmody, inventor (to NASA) Filed 18 Oct. 1968 9 p
(NASA-Case-XMF-9386; US-Patent-Appl-SN-768671) Avail: CFSTI

A portable, electromechanical hand tool for cutting and sealing fusible cloth is described. The cutting and sealing is done by a heater wire mounted in a sine wavelike pattern on a ceramic rotatable wheel about three inches in diameter. In operation the wire is electrically heated to a predetermined temperature (300°F for nylon and 500°F for various other fusible fabrics) prior to cutting. The tool is then guided by the operator so that the ceramic wheel rolls over the material along the desired lines. The heated wire cuts the material, producing a serrated edge, and heat seals the ends of the threads to prevent raveling. NASA

N69-21855*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAP FOR PREVENTING DIFFUSION PUMP BACKSTREAMING
Harold Shapiro, inventor (to NASA) Filed 31 Dec. 1968 9 p
(NASA-Case-CSC-10518; US-Patent-Appl-SN-789045) Avail: CFSTI

Details are given on a trap to be located between an oil diffusion pump and a vacuum system for trapping oil molecules which tend to migrate or backstream from the pump into the evacuated system. The invention comprises a conduit having walls which form an open ended box. A first baffle plate has a smooth side adjacent to the evacuated system and a roughened side facing the pump. A second baffle plate has both of its main surfaces roughened. In this respect, the baffle plates can be roughened by milling 60° equilateral pyramids on the surfaces. Oil molecules from the pump coalesce on the roughened surfaces of the baffle plates to form drops of oil which then run or fall from the baffle plates so as to be returned to the pump. NASA

N69-21856 British Hydromechanics Research Association, Harlow (England).
WEAR TESTING
D. Reddy and B. S. Nau. Mar. 1968. 29 p. refs
(TN-940) Copyright. Avail: Issuing Activity: $6.00

The literature of wear testing has been examined and the many types of test machine used have been systematically classified and cross-referenced to selected literature references giving further details for specified operating conditions. The principal wear processes are listed and explained and wear measurement and analytical methods are also reviewed. Author

N69-21862*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURIZED PANEL
Erskine C. White, inventor (to NASA) Filed 21 Nov. 1968 9 p
(NASA-Case-XLA-8916; US-Patent-Appl-SN-777765) Avail: CFSTI

An apparatus and method for making relatively flat, large area pressurized meteoroid penetration detector panels are described. The structure of the panels includes an interconnected cellular configuration in which the cells have spaced periphery welds and tufts in their centers at which point a spot-weld is made. The panels are produced by preweiding sheets of metal together, and then pressure-forming them by placing them in a peripheral clamp and utilizing air pressure to expand the panel sides against two surface restricting shims. NASA

N69-21877*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TUBE FABRICATING PROCESS
John G. Davis, Jr., inventor (to NASA) Filed 22 Oct. 1968 13 p
(NASA-Case-UAR-10203-1; US-Patent-Appl-SN-769592) Avail: CFSTI

This invention relates to a process for fabricating plastic tubes and relates in particular to a novel process for fabricating small plastic tubes having longitudinal filamentary reinforcement wherein the exterior and interior of the tubes are smooth and of suitable quality for use in research and development programs. The invention consists of providing a plurality of filament reinforced epoxy strips with the filaments disposed in the longitudinal direction of the strip, wrapping the strips sequentially on a mandrel with the width of each strip being such that a one-sixteenth inch overlap is maintained for each ply of material, slidably positioning a heat shrinkable polytetrafluorethylene sleeve snugly over the wrapped strips, heating the sleeve to tightly engage the wrapped strips, positioning a steel tube around the resulting assembly, and curing in a heated circulatory-air oven to cure the filament reinforced plastic. After curing and cooling to room temperature the steel tube is removed, the heat shrinkable sleeve is peeled off, and the mandrel extracted to leave a smooth surface filament reinforced plastic tube. NASA

N69-21917# Finnish Academy of Technical Sciences, Helsinski.
ON THE NUMERICAL CALCULATION OF THE FLEXURAL CRITICAL SPEEDS OF A ROTATING MULTISPAN SHAFT
Ilmari Sala (Tech. Univ., Helsinki) 1968 24 p. refs. *Its* Acta Polytech. Scand., Mech. Eng. Ser. No. 34
(PB-180788; APS-ME-34) Avail: CFSTI CSCL 13I

In these calculations, the known fourth-order homogeneous differential equation with homogeneous boundary conditions, which are dependent upon the structure of the bearings, was replaced by two simultaneous second-order differential equations. Following this, the problem is presented in the form of two simultaneous integral equations, of which the solution is replaced by calculation of the eigenvalue of a matrix product. The method outlined above is now applied to a shaft running in a number of bearings. The boundary conditions at each of the intermediate bearings, which are common to both of the consecutive spans, render it possible to present the whole problem as an eigenvalue of a matrix product. (Author) USGRDR

N69-21922*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
CATALYST FOR GROWTH OF BORON CARBIDE SINGLE CRYSTAL WHISKERS
Robert F. Cree and Arno Gatti, inventors (to NASA) Issued 21 Jan. 1969 (Filed 22 Jun. 1966) 3 p Cl. 23-208
(NASA-Case-XHQ-3903; US-Patent-3,423,178; US-Patent-Appl-SN-560967) Avail: US Patent Office

The invention relates to the production of boron carbide whiskers by vapor deposition from either vaporized boron carbide

powders, or gas phase reactions of boron trichloride with methane and hydrogen. The invention generally comprises the addition of a catalyst selected from the group consisting of vanadium, niobium, or molybdenum to the boron carbide source whereby the whisker producing activity of the source is increased. The catalytic technique is generally practiced in two different ways dependent upon whether it is to be utilized with the pure vapor method or with the chemical reaction technique. In the former, the catalyst is added as pure metal to the boron carbide powders which are to be subsequently vaporized. In the latter, the metal is added as a decomposable gas directly to the chemical reaction gas stream. It is preferable to use amounts of catalytic material greater than .01 percent by weight of the amount of boron carbide utilized in the pure vapor method. About 1-5 mol percent decomposable metal containing gas compound is utilized in the chemical reaction method. NASA

N69-21924*# Garrett Corp., Los Angeles, Calif.
RELIEF VALVE
Johannes Steenken, inventor (to NASA) Issued 14 Jan. 1969 (Filed 27 Nov. 1967) 6 p Cl. 137-491
(NASA-Case-XMS-05894-1; US-Patent-3,421,541; US-Patent-Appl-SN685766) Avail: US Patent Office

A pressure relief valve, which permits a slow bleed rate at one pressure level and a high bleed rate at a higher pressure level, is described. The valve mechanism comprises a housing having an internal bore in which is slidably mounted a hollow sleeve valve element. The sleeve valve normally closes off flow between the inlet port and a flow passage leading to the outlet port. An orifice in the sleeve valve element communicates the inlet pressure with a ball valve also mounted in the housing bore and which also shuts off flow to the outlet through a second flow passage. A single spring biases the sleeve valve and ball valve elements to closed positions. A Belleville spring diaphragm assembly, also mounted in the housing bore, senses pressure differential between inlet and outlet ports and deflects at a predetermined inlet pressure to unseat the ball valve and permit a slow pressure bleed to maintain system pressure within acceptable limits. Should a far greater inlet pressure occur, the restriction in flow through the orifice in the sleeve valve element creates a pressure differential across the sleeve valve element which acts against the spring bias to unseat the sleeve valve and permit a much higher bleed rate. Official Gazette of the U.S. Patent Office

N69-21936# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONVEYER INSTALLATION FOR ELECTRIC INSULATION ANODIZING OF ALUMINUM WIRE
L. N. Dirkgan, V. M. Gevorkyan, M. I. Garbera, and N. V. Rumyantseva Aug. 1968 32 p Transl. into ENGLISH from Avtomatiz. i Mekhaniz. Galvanicheskikh Protsessov, Sb. (Moscow), 1965 p 303-323
(AD-681607; FTD-MT-24-225-68) Avail: CFSTI CSCL 13/8

An apparatus for continuous anodizing of aluminum wire and the technology of this process are both described in detail. Methods for testing the quality of oxide films are examined. The physical and mechanical properties of the obtained coatings are given. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-20942 Case Western Reserve Univ., Cleveland, Ohio.
FREQUENCY SHIFTS INHERENT IN THE 6328 ANGSTROM HELIUM-NEON LASER
Thomas P. Sosnowski (Ph.D. Thesis) 1967 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-10186

The effects of various discharge tube parameters on the center frequency of the Doppler-broadened ($3s_2$–$2p_4$) 6328 Ang. lasing transition in Ne^{20} and Ne^{22} have been measured. Frequency shifts from 17 1/2 to 23 MHz./torr were measured in the discharges depending on the combination of helium and neon isotopes used. The shift of the peak frequency with discharge tube current was immeasurable. In addition, it has been found that the peak frequency is dependent on the relative position of the tube axis with respect to the cavity axis, the variation for small bore tubes being of the order of 20 MHz./0.1 mm. An analysis was made of the possible causes for the pressure-frequency shifts, the result being that they may be attributed to collisions between the excited neon atoms and ground state helium atoms. Dissert. Abstr.

N69-20983 Illinois Univ., Urbana.
MOLECULAR VIBRATIONS: THE SULFUR–SULFUR BOND IN ELEMENTAL SULFUR AND CONSTRUCTION OF A LASER-RAMAN SPECTROGRAPH
Edward Bromels (Ph.D. Thesis) 1968 219 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-12087

The construction of a laser-Raman spectrograph is described. The pulsed-ruby laser has an output ranging from 5 to 45 joules. The spectra obtained with five pulses of the laser are comparable to spectra obtained using He-Ne lasers. However, alignment difficulties hampered extensive utilization of the system. Infrared and Raman spectra of sulfur-six, including complete polarization data for solutions, provided assignments for the fundamental modes. Force fields that have been successful for sulfur-eight were transferred to sulfur-six. They gave good agreement and were helpful in assigning the frequencies to the proper mode, but were not good enough to provide new information about the S-S bond. Various valence force and Urey–Bradley force fields were fitted to the frequencies of S_8 and S_8. Within the framework of a linear hypothesis test, a four-parameter valence force field gave the best fit. Addition of other constants gave no significant improvement. Dissert. Abstr.

N69-21215# Royal Aircraft Establishment, Farnborough (England).
A LIQUID CALORIMETER FOR THE MEASUREMENT OF LASER ENERGY
Jennifer Foster, C. Appleyard, and D. W. P. Jones Apr. 1968 30 p refs
(RAE-TM-WE-1271) Avail: CFSTI

A liquid calorimeter for the measurement of laser output energy is described. The laser energy is absorbed in a 5.9% by weight aqueous solution of nickel sulphate. The instrument is designed to function over the range 10 to 300 joules. By optimising the concentration of the liquid solution an accuracy of ±5% should be possible. Author (ESRO)

N69-21612# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MIXING OF RUBY AND NEODYMIUM LASER OUTPUTS
N. N. Belyaeva et al 28 Mar. 1969 7 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii. Radiofiz. (Gorki), v. 10, no. 2, 1967 p 294–296
(AD-681812; FTD-HT-23-212-68) Avail: CFSTI CSCL 20/5

The outputs of two synchronized ruby (1.06 micrometers) and neodymium glass (1.06 micrometers) giant-pulse lasers pumped by 1000- and 600-j xenon flashlamps, respectively, were mixed.

Q-switching was done by means of a total-internal-reflection prism rotating at 14000 rpm. A KDP crystal was used as the nonlinear element. The output power of each laser at the sum frequency of 0.42 micrometers was 1.3 Mwt. A comparative analysis was made of the sum-frequency output and the power of the second harmonic of the neodymium glass laser. Based on this comparison, the resultant output at the sum frequency was about 1.4 times less than the power of the second harmonic of the neodymium glass laser, viz., 40 kw. Author (TAB)

N69-21618# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN LASER ABSTRACTS, VOLUME 2, NUMBER 1 Surveys of Foreign Scientific and Technical Literature
Jan. 1969 66 p refs
(AD-682303; ATD-69-44) Avail: CFSTI CSCL 20/5

Contents: Gas: Molecular beam; Semiconductor; Liquid or organic media; Emission characteristics--generation dynamics; Spectroscopy of laser materials; Components; Nonlinear optics; Interaction of light energy with matter; Interaction of laser beam with atmosphere; and Organizational events. TAB

N69-21683*# GCA Technology Div., GCA Corp., Bedford, Mass.
STUDY OF THEORY AND APPLICABILITY OF LASER TECHNIQUE FOR MEASURING ATMOSPHERIC PARAMETERS Interim Scientific Report
J. Pressman, C. Schuler, and T. Wentink Oct. 1968 170 p refs
(Contract NAS12-540)
(NASA-CR-86134; GCA-TR-68-6-N) Avail: CFSTI CSCL 20E

The nature of laser energy interactions in the atmosphere is examined as a basis for the design and operation of modulated, coherent ground-based laser communications links in planetary atmospheres. Atmospheric constituents were categorized as potential resonant scattering species to assist in the selection of optimal communications system operational wavelengths. The basic objective was the performance of a critical and systematic analysis of the absorption characteristics of real atmospheric constituents. A bibliographic survey was carried out to establish suitable techniques of obtaining data on major and trace constituents of planetary atmospheres appropriate to the laser interaction problem. Planetary atmospheric parameters are established, a mathematical analytical treatment of the general laser probe problem is presented, and the area of Raman scattering in atmospheric gases is discussed. Laser analysis of isotopic abundances is considered and an analysis is presented of the feasibility of measuring the ambient wind field using laser density observations from a ground based site. B.G.D.

N69-21684# Joint Publications Research Service, Washington, D. C.
CARBON DIOXIDE LASERS IN SPACE COMMUNICATIONS
V. Vasil'yev and V. Yevgen'yev 3 Mar. 1969 8 p Transl. into ENGLISH from Znanie Sila (Moscow), Nov. 1968 p 6-7
(JPRS-47557) Avail: CFSTI

A nontechnical account of the discoveries of the ruby laser and the carbon dioxide laser is given. Properties of two lasers used as space communicators are discussed. B.G.D.

N69-21742# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE EFFECT OF RESONATOR DETUNING ON THE OUTPUT ENERGY OF A RUBY LASER AS A FUNCTION OF THE ORIENTATION OF THE OPTICAL AXIS
K. I. Krylov et al Jul. 1968 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Priborostr. (Leningrad), v. 10, no. 11, 1967 p 89-92
(AD-681604; FTD-MT-24-211-68) Avail: CFSTI CSCL 20/5

The effect of resonator detuning on the output energy of a ruby laser while varying the position of the optical axis in relation to the direction of detuning was studied. The investigation was carried out using three ruby rods 8 mm in diameter and 120 mm in length, 12mm in length, and 14mm in length. The resonator, with an 80-cm base, consists of mirrors with reflection coefficients of R1 = 79% and R2 = 99.5%. The resonator was tuned with reference to the end plane of the ruby rods to an accuracy of 10 to the 11th power. Detuning was performed by turning the mirror R2 about its vertical or horizontal axis. The ruby rods were oriented in such a way that their optical axes were located in a horizontal plane. It is pointed out that this dependence should be taken into consideration in lasers with mechanical modulation of the Q-factor. TAB

N69-21774# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BEAM PROFILE EFFECTS IN LASER SAFETY ANALYSIS
Paul H. Deitz and Peter M. Livingston Dec. 1968 14 p refs
(AD-681907; BRL-TN-1710) Avail: CFSTI CSCL 20/5

The application of the probability of damage parameter for bounded waves with non-homogeneous wave fronts is discussed. The first approach treats the beam profile as a series of quasi-homogeneous energy density regions. The second approach consists of a generalized analysis applied to beams for which an analytical form of the profile is known. Author (TAB)

N69-21872# Ballistic Research Labs., Aberdeen Proving Ground, Md.
OPTICAL PROPAGATION IN A NEAR-EARTH ENVIRONMENT
Paul H. Deitz Dec. 1968 14 p refs
(AD-681905; BRL-TN-1708) Avail: CFSTI CSCL 20/5

This report describes optical measurements of the magnitude of scintillation as a function of the range and refractive index structure coefficient. The results are compared with the Tatarski and deWolf geometrical optics saturation equations. In addition, a variation in the Kolmogorov turbulence model is suggested to account for certain observed optical and meteorological parameters. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-20701# National Academy of Sciences—National Research Council, Washington, D. C. Materials Advisory Board
TECHNOLOGICAL INFLUENCE ON USAGE OF PLATINUM AND PALLADIUM Annual Report
Dec. 1968 31 p refs
(Contract DA-49-083-OSA-3131)
(AD-681367; MAB-247) Avail: Issuing Activity CSCL 11/6

Imports of platinum have nearly doubled in the last ten years and were 363,700 Troy ounces in 1967; palladium imports totaled 737,100 ounces in 1967. Since nearly 90% of the platinum and over 80% of the palladium are used in industrial applications, it appeared appropriate to assess the trends in future requirements and the possible substitutes for these metals. While some fields of application appear to be declining, the general trend is for greater demand of both platinum and palladium. The limited substitution possibilities are discussed. Author (TAB)

N69-20706# California Univ., San Diego. Dept. of the Aerospace and Mechanical Engineering Sciences.
THE ENLARGEMENT OF A HOLE IN A RIGID-WORKHARDENING DISK OF NON-UNIFORM INITIAL THICKNESS
Jenn-Ming Chern and S. Nemat-Nasser Jan. 1969 45 p refs
(Contract N00014-67-A-0109)
(AD-681360; TR-28) Avail: CFSTI CSCL 20/11

A complete solution is obtained for the enlargement of a circular hole in a disk using an isotropic strain-hardening law with mises' yield condition and its associated flow rule. The results are then compared with those obtained using: (1) Tresca's yield condition and its associated flow rule; (2) Mises' yield condition for the neutral plastic region, and Tresca's yield condition and the flow rule associated with the Mises yield criterion for the active plastic region; and (3) Tresca's yield condition for all plastic regions and the Saint Venant–Levy–Mises flow rule. An interesting feature of the results is that, when material hardening exists and when the Saint Venant–Levy–Mises flow rule is used, then, as the hole expands, there first occurs a thickening of the disk at the vicinity of the hole's edge, which thickening may then be followed by a thinning. It appears that this phenomenon has not been noticed before. Author (TAB)

N69-20707 New Mexico Univ., Albuquerque.
LATTICE DYNAMICS OF BISMUTH
Darryl B. Smith (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-11667

Dispersion curves for phonons propagating in the binary and ΓX directions in bismuth at 75°K were measured by inelastic neutron scattering. A group theoretical analysis of modes of vibration in the bismuth lattice was made. The results were used to label the branches of the dispersion relation, and to reduce the dynamical matrices for phonon propagation in the trigonal, binary, and ΓX directions to block diagonal form. Both a second neighbor general force model and this model augmented by the inclusion of axially symmetric third and fourth neighbor force constants were constructed and were fitted to the present data and to previous data for the trigonal direction. It was concluded that forces due to atoms beyond fourth nearest neighbors are required to fit the data within the experimental errors. The phonon frequencies at the symmetry points in the Brillouin zone were used along with a recent measurement of the electron-hole recombination time in bismuth to determine the location of the valence band maxima. Dissert. Abstr.

N69-20711# Naval Research Lab., Washington, D. C.
INITIAL ASSESSMENTS OF NOTCH DUCTILITY BEHAVIOR OF A533 PRESSURE VESSEL STEEL WITH NEUTRON IRRADIATION Final Report
J. Russell Hawthorne and Uldis Potapovs Nov. 1968 23 p refs
(AD-681373; NRL-6772) Avail: CFSTI CSCL 18/10

Exploratory assessments were made of the Charpy-V notch ductility characteristics of heavy section A533-B and A533-C steel plate and submerged arc weldments following neutron irradiation at 550F. The experimental evaluations were performed largely with commercial production materials and included comparisons of materials in both Class 1 and Class 2 strength ranges. Postirradiation notch ductility properties of one 5-3/4-in. A533-B Class 1 electroslag weldment were also developed. Assessments made of relative irradiation performance were assisted by a compilation of recent information on the response of the ASTM reference A302-B steel plate. Major research findings include the observation of significant variability in radiation embrittlement sensitivity of A533-B and A533-C steel wherein the sensitivity level of plate and weld metal in some cases exceeded that of the ASTM reference plate. High radiation embrittlement sensitivity was noted for both submerged arc weld deposits examined; however, the data suggest that the performance of the weld-heat-affected zone parallels that of the parent plate. High embrittlement sensitivity was also noted for the electroslag weld deposit, in contrast to markedly low sensitivity of the weldment parent plate. The notch ductility behavior of A533 plate and weld metal under 550F irradiation was not found to be measurably influenced by either the strength class (Class 1 or 2) or by the particular grade of steel (Grade B or C). Similarly, there were no marked variations in irradiation response through the thickness of plate or weld metals, or between RW (longitudinal) versus WR (Transverse) orientations in cross-rolled plate. Author (TAB)

N69-20745 Cornell Univ., Ithaca, N. Y.
SOME FERROMAGNETIC EFFECTS IN THE ELECTRICAL RESISTIVITY OF NICKEL
Friedrick Carl Schwerer, III (Ph.D. Thesis) 1968 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-11644

In addition to the contributions to the resistivity found in normal metals there are several effects in the transport properties of ferrometals which are associated with the existence of a spontaneous magnetic moment. In particular, inhomogeneities in the ordered spin state affect the scattering of conduction electrons and Lorentz forces from the spontaneous magnetization field $4\pi M_s$ alter the electron transport properties as an applied magnetic field does in a normal metal. Both of these effects are anisotropic with respect to the magnetization. In this investigation the electrical resistivity of polycrystalline nickel foils was analyzed for the first effect with respect to the anisotropy in the scattering process resistivity and for the second effect through an application of Kohler's Rule $(\rho(B)-\rho_0)/\rho_0 = F(B/\rho_0)$. The resistivity was measured by a four probe technique in applied magnetic fields (to 18 kOe) parallel and perpendicular to the measuring current. The resistivity of pure nickel (residual resistivity ratio ≈2500) was measured from 1.5°K to 150°K. Resistivity measurements of dilute, nickel-base alloys of chromium (5 to 1400 ppm), iron (10 to 9000 ppm), and carbon (3 to 1100 ppm) and of deformed nickel samples (dislocation densities to $\approx 10^{12}$ lines/cm^2) were made at 4.2°K. Samples doped with cobalt and manganese and by gas chemistry provided corroborating evidence. Dissert. Abstr.

N69-20789*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SOLUBILITIES OF VANADIUM, TITANIUM, AND ZIRCONIUM IN LIQUID POTASSIUM
Stephan Stecura Washington Mar. 1969 21 p refs
(NASA-TN-D-5093) Avail: CFSTI CSCL 07D

The solubility of vanadium in liquid potassium containing less than 20 wt ppm of oxygen between 1012 and 1341 K is about 8 to 70 wt ppm, respectively. The heat of solution for the vanadium solubility is 21 ± 4 kilocalories per mole (87.9 kJ/mole). Titanium and zirconium solubilities in liquid potassium between 1020 and 1341 K are less than 4 and 10 wt ppm, respectively. Vanadium, titanium, and zirconium solubilities were studied in potassium doped with potassium nitrate (KNO_3). The data suggest that KNO_3 is not a good doping agent for determining the effect of oxygen on the solubilities of transition metals in liquid potassium. Author

N69-20823# National Physical Lab., Teddington (England). Div. of Materials Applications.
THE RELATIONS BETWEEN THE APPLIED LOAD AT FRACTURE, THE CRITICAL FRACTURE STRESS, THE PROOF STRESS AND THE PLASTIC STRESS-CONCENTRATION FACTOR IN HIGH-STRENGTH STEELS

J. H. Rendall Nov. 1968 24 p refs
(NPL-DMA-20) Copyright. Avail: CFSTI

This paper discusses the values and importance in the fracture at notches of high-strength steels, of the plastic stress concentration factor, R = 1max/Y, where 1max is the highest tensile stress in the volume beneath the notch and Y is the plain tensile proof stress. It is assumed, following a number of authors, that fracture occurs when σ_{1max} reaches a critical value F. If R is put equal to a linear function of nb/σ_Y, where nb is the maximum fibre stress at the root of the notch, ignoring the elastic stress concentration, and σ_F is put equal to a linear function of Y, it is shown that nb_F, σ_{nb} at fracture, will, if fracture occurs before general yield, decrease with increase in Y unless dF/dY > about 0.3 to 0.8. Such an increase in fracture stress is unlikely and thus the model is consistent with the decrease in notch toughness often found with increase in proof stress. The critical value of dF/dY depends on R and therefore the determination of R by other authors are discussed and it is decided that if the von Mises yield criterion holds a probable value of R up to general yield is given by R = 0.79 [nb/XYx −20.323] +1.12. Author (ESRO)

N69-20847# Lehigh Univ., Bethlehem, Pa.
DETERMINATION OF THE THERMODYNAMIC PROPERTIES OF LIQUID METAL SOLUTIONS AT HIGH TEMPERATURES Final Report
S. K. Tarby and V. S. Robinson, III Oct. 1968 37 p refs
(Contract DA-31-124-ARO(D)-329)
(AD-679061; AROD-5404:2-MC) Avail: CFSTI CSCL 11/6

The transportation method was used to determine the vapor pressure of silver above pure liquid silver and above molten Ag-Si alloys in the temperature range of 1450 to 1600C. The experimental values of the vapor pressure of pure liquid silver were related to temperature and a complete thermodynamic description of liquid Ag-Si alloys was achieved. Author (TAB)

N69-20850*# General Electric Co., Philadelphia, Pa. Re-Entry Systems.
ELECTROFORMING OF ALUMINUM COMPOSITE STRUCTURES BY CODEPOSITION OF HIGH STRENGTH, HIGH MODULUS FIBERS OR WHISKERS Final Report
A. G. Buschow, C. H. Esola, I. J. Hess, D. B. Kreitz, and F. J. Schmidt 11 Mar. 1969 56 p refs
(Contract NAS1-7913)
(NASA-CR-66749) Avail: CFSTI CSCL 11D

Process scale-up studies were conducted in the 0.757 m^3 (200 gallon) capacity pilot cell, with the electroforming of a composite structural element, representative of solar array panel section, as an end goal. A laboratory investigation sought to establish codeposition techniques for incorporating high strength, high modulus fibers into an electroformed aluminum composite. Program objectives were met and all the contract required items were successfully electroformed in the pilot cell. The laboratory investigation concluded that the graphite fiber-aluminum system was the most promising of the various systems studied. These composites exhibited an ultimate tensile strength up to 224 MN/m^2 vs. 76MN/m^2 (32,400 psi vs. 11,000 psi) for plain electroformed aluminum and a modulus of elasticity up to 91.1 GN/m^2 vs. 55.2 GN/m^2 (13.2×10^6 psi vs. 8×10^6 psi) for plain electroformed aluminum. The laboratory process steps were successfully scaled-up in the pilot cell. A graphite fiber-aluminum composite structural element was electroformed in the pilot cell. Author

N69-20885# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
FRACTURE TOUGHNESS OF HIGH-STRENGTH STEELS FOR MILITARY APPLICATIONS
J. E. Campbell Aug. 1968 30 p refs
(Contract F33615-68-C-1325)
(AD-681424; DMIC-M-239) Avail: CFSTI CSCL 11/6

The Memorandum discusses the current situation on the inclusion of fracture-toughness testing requirements in specifications for high-strength steels used for military applications. The Memorandum was prepared at the request of The Technical Cooperation Program (TTCP), and contains information from Canadian and British members of that program, as well as U. S. information. Military applications discussed include missile motor cases, aircraft landing gear, gun tubes, armor plate, and hydrofoils. Author (TAB)

N69-20891 Illinois Univ., Urbana.
THE THIRD ORDER ELASTIC CONSTANTS OF ALUMINUM
Joseph Francis Thomas, Jr. (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-12207

The complete set of six third order elastic constants of single crystal Al has been experimentally determined by measuring both hydrostatic pressure and uniaxial stress derivatives of the natural sound velocities using a two specimen interferometric technique. The values obtained are $C_{111} = -10.76$, $C_{112} = -3.15$, $C_{123} = +0.36$, $C_{144} = -0.23$, $C_{166} = -3.40$, and $C_{456} = -0.30$ in units of 10^{12} dyn cm^{-2}. The specimens were neutron irradiated to eliminate dislocation effects from the uniaxial experiments. A self-consistent set of hydrostatic pressure derivatives of the second order elastic constants has been calculated from the measured third order elastic constants. The third order elastic constants have also been used to calculate the thermal expansion in the anisotropic continuum model at both high and low temperatures, and a comparison has been made to the directly measured expansion coefficients. Dissert. Abstr.

N69-20923*# Aztec School of Languages, Acton, Mass. Research Translation Div.
THE EFFECT OF SURFACE AND COATING TREATMENTS ON THE EMBRITTLEMENT OF STEEL AT HIGH RESISTANCE BY HYDROGEN UNDER PRESSURE: THE CASE OF 35 NiCrMo 16 STEEL [INFLUENCE DE TRAITEMENTS DE SURFACE ET DE REVETEMENTS SUR LA FRAGILISATION D'ACIERS A HAUTE RESISTANCE PAR L'HYDROGENE SOUS PRESSION: CAS DE L'ACIER 35 NiCrMo 16]
Jean-Pierre Fidelle et al Washington NASA Feb. 1969 19 p refs
Transl. into ENGLISH from French conf. paper Conf. Presented at 7th Intern. Congr. on the Treat. of the Surface of Metals, Henovre, France 5–9 May 1968
(Contract NASw-1692)
(NASA-TT-F-12089) Avail: CFSTI CSCL 11F

It is shown that gold, aluminum, and cadmium can protect disks for several months, which would be broken after a few minutes under hydrogen pressure if there were no coating. The authors analyze the cause and nature of the rupture of 35 NiCrMo 16 steel under various pressures. Author

N69-21012 Columbia Univ., Palisades, N. Y.
A FIELD ION MICROSCOPE INVESTIGATION OF THE TUNGSTEN–RHENIUM–OXYGEN SYSTEM
David Theodore Novick (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-11730

Bright spots, appearing in field ion micrographs of pure tungsten and alloys of tungsten with 1-1/4% and 3% rhenium, found in a triangular region defined by the [011], [121], and [112] poles are studied as a function of oxidation treatment and rhenium concentration. The concentration of these bright spots is found to increase in all three materials as a result of oxidation, the relative

increase being the same in all cases. Additionally, the concentration of bright spots increases proportionally to the rhenium concentration independent of the treatment. The simplest interpretation for these observations is that the bright spots are due to oxygen in interstitial solid solution. Tests on the data lead to the conclusions that the rhenium bearing alloys contain Re–O clusters which obey the Mass Action Law and that the solubility of oxygen at defect free sites adjacent to tungsten atoms alone, is unaffected by the presence of rhenium in solution. Dissert. Abstr.

N69-21014 Stanford Univ., Calif.
THE INFLUENCE OF GRAIN SIZE ON THE PORTEVIN–LE CHATELIER EFFECT
Martin Daniel Merz (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-11325

An investigation of the Portevin-Le Chatelier effect (serrated yielding) in an aluminum-5% magnesium and an iron-3% silicon alloy was carried out. In the substitutional alloy Al-5% Mg grain size affects both the magnitude of the serrations and the strain at which these serrations begin. The magnitude of the stress fluctuations, $\Delta\sigma$, obeys the relation $\Delta\sigma = A + Bd^{-1/2}$, where A and B are constants and d is the main grain diameter. It is suggested that the yielding phenomenon associated with the Portevin-Le Chatelier effect is similar to that of the more usual yield point observed at the beginning of straining. A model was developed which predicts the observed dependence of the strain at which serrations begin on temperature, strain rate, and grain size. This model takes into account the effect of vacancy annihilation as well as vacancy creation during straining and predicts the observed disappearance of serrations as the temperature of testing is increased. Dissert Abstr.

N69-21026 Stanford Univ., Calif.
SUPERPLASTICITY IN METALS
Charles Maurice Packer (Ph.D. Thesis) 1968 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-11333

The objectives of this investigation were (1) to characterize the superplastic effect in certain alloys; (2) to define the important mechanisms operative during superplastic processes; and (3) to develop an analytical expression to predict the mechanical behavior of superplastic materials. Experimental activities were directed toward analysis of superplasticity in zinc–aluminum alloys. Special equipment was assembled for extension of specimens at elevated temperatures under constant stress. This equipment permitted instant changes in stress or temperature, facilitating the measurement of activation energies and stress exponents. (In the general relationship between stress σ and strain rate $\dot{\epsilon}$, $\dot{\epsilon} = K\sigma^n$, K is a constant and n is the stress exponent.) In addition, this test equipment allowed the specimen to be quenched to room temperature immediately after the test, thereby precluding any changes in microstructure which would occur during a normal, slow cool to room temperature. Specialized metallographic techniques were developed to study microstructure with light microscopy at magnifications to 3000X. Dissert. Abstr.

N69-21036# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
STUDY OF THE TERNARY ALLOYS OF URANIUM–MOLYBDENUIM–NIOBIUM, AND URANIUM–MOLYBDENIUM–ZIRCONIUM WITH LOW URANIUM CONTENT [STUDIO DI LEGHE TERNARIE DI URANIO–MOLIBDENO–NIOBIO E URANIO–MOLIBDENO–ZIRCONIO A BASSO TENORE DE LANGANTE]
C. Fizzotti and A. Masperoni 1968 80 p
(Contract EURATOM/CNEN/SNAM-009/62/6)
(RT/MET(68)5) Avail: CFSTI

In order to improve the irradiation resistence of metallic uranium, ternary alloys containing Mo + Nb and Zr + Mo were investigated. The structures obtained in these alloys by different heat-treatments were characterized by long term annealing, thermal cycling, mechanical tests, etc. Some isothermal sections of the ternary system U–Mo–Nb are also shown. A few of these heat-treated alloys were selected for irradiation tests. Author

N69-21043*# Brigham Young Univ., Provo, Utah.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE Quarterly Report
Eliot A. Butler and Angus U. Blackham 15 Feb. 1969 34 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952268)
(NASA-CR-100465; Rept-69-16; QR-3) Avail: CFSTI CSCL 11F

Modification to the cyclic current-step (c.c.s.) apparatus to reduce the direct current signal to less than ± 0.2 μa are described. Measurements for the ferrous-ferric, Ag–$Ag(NH_3)_2^+$, Ag–Ag_2O systems and for an equivalent circuit are compared. Measurements of the oxide layer (Ag_2O and AgO) resistance show an increase in the resistance with electrode cycling. The use of oxide layer resistance measurements for further study of the Ag → Ag_2O → AgO system is discussed. Additional data are presented comparing the methods of constant current charging and potentiostatted charging for surface area estimation. Roughness factors of 58 and 81 respectively are reported for these two methods applied to porous sintered silver electrodes. The height of the initial current peak as a function of potential for potentiostatted charging is reported and discussed for smooth silver electrodes. The effects of ultrasonic vibrations applied during various oxidation steps have been studied. Author

N69-21047# Douglas Aircraft Co., Inc., Santa Monica, Calif.
USE OF ELECTRON MICROAUTORADIOGRAPHY FOR EVALUATING MICROSEGREGATION OF HYDROGEN IN TITANIUM ALLOYS
N. A. Tiner, T. L. Mackay, S. K. Asunmaa, and R. G. Ingersoll Sep. 1968 22 p refs Presented at Am. Soc. of Metal 1968 Westec Conf., Los Angeles, 11–14 Mar. 1968
(Douglas Paper-4738) Avail: Issuing Activity

Microsegregation of hydrogen in titanium alloys is evaluated by the use of a new microautoradiography technique. The radioactive isotope of hydrogen (tritium) is introduced into the alloys, and its segragation in the beta phase is determined. The details of the technique are discussed, and the microsegregation determinations made in alpha–beta, near alpha, and beta alloys are described. It was discovered that hydrogen occurred in a concentration of 200 to 300 ppm in the beta phase of the alpha–beta alloys with less than 50 ppm total hydrogen content. The use of the technique to study distribution of trace elements between microphases and their effect on the alloy properties is suggested. Author

N69-21165# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
STRAIN CAUSED BY RECOVERY OF RADIATION DAMAGE IN A ZIRCALOY PRESSURE TUBE [CONTRAINTE CAUSEE PAR LE RETABLISSEMENT D'UN DOMMAGE DE RADIATION DANS UN TUBE DE PRESSION EN ZIRCALOY]
G. R. Piercy and J. Lori Dec. 1968 11 p refs
(AECL-3226) Avail: Available from Atomic Energy of Can., Ltd., Chalk River: $0.50

The circumferential strain of rings cut from cold worked Zircaloy-2 pressure tubes after irradiation to 9.7×10^{20} n/cm^2 > 1 MeV was compared with that of annealed rings during heating to 400°C. A circumferential strain of less than 10% of the creep

strain produced during irradiation was caused by the anneal. This eliminates the possibility of the main component of the irreactor creep being caused by the preferred alignment of those small dislocation loops which anneal at 400°C. Author

N69-21206# National Physical Lab., Teddington (England). Div. of Materials Applications.
A MAXIMUM LOCAL TENSILE STRESS CRITERION FOR FRACTURE IN HIGH-STRENGTH STEELS
J. H. Rendall Mar. 1968 18 p refs Presented at the Conf. on Fracture Toughness of High Strength Mater., Sheffield, Engl., Mar. 1968
(NPL-Met-App-2; NPL-DMA-6; NPL-B-455) Copyright. Avail: CFSTI

It is suggested that a notched bar breaks by cleavage fracture when it has deformed sufficiently for the plastic stress intensification factor, R, to equal σ_F/σ_Y, where σ_F is the value at fracture of σ_1, the highest value in the bar of principal tensile stress, determined by continuum mechanics, and σ is the proof stress in plain tension. If, in fact, fracture initiates as soon as a local intensification of stress, raises the local tensile stress from σ_1 to a value of σ_1 (local) = σ_{FT}, the probability of such a fracture initiation depends on: (1) the values in the vicinity of the notch of the principal stresses σ_1, σ_2, σ_3, at fracture; (2) The statistical distribution and potency of the stress concentrations in the material; and (3) The volume V in which high values of σ_1, σ_2, and σ_3 exist. Provided that the functions R and V have been evaluated by a statical analysis of a large number of notch tests, it should be possible to determine from the breaking load of a notched test piece that fractures before general yield a function, S_{FM} which depends on the notch strength of the material and is independent of the size and geometry of the test piece. The utility of S_{FM} as a design criterion is compared with K_{Ic}. Author (ESRO)

N69-21249# European Atomic Energy Community, Ispra (Italy). Metallurgy and Ceramics and Technology.
STABILITY AND COMPATIBILITY OF HYDROGEN BARRIERS APPLIED TO ZIRCONIUM ALLOYS
F. Brossa, F. Coen, H. W. Schleicher, and G. Volta 1969 42 p refs
(EUR-4098.E) Avail: CFSTI

Many coatings have been tried to protect against hydrogen pick-up Zircaloy 2 in contact with terphenyl. Methods of deposition of different coatings and their efficiency as hydrogen diffusion barriers are described. It was found that the most promising barrier against hydrogen diffusion is an Al–Si coating. Results of compatibility tests between Al–Si and Zircaloy 2 are reported. Different methods have been tried to obtain efficient coatings on laboratory scale. Author

N69-21404*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION OF CERMETS OF URANIUM NITRIDE AND TUNGSTEN OR MOLYBDENUM FROM MIXED POWDERS AND FROM COATED PARTICLES
Philip D. Takkunen Washington Apr. 1969 35 p refs
(NASA-TN-D-5136) Avail: CFSTI CSCL 11B

Cermets containing uranium nitride particles dispersed in a matrix of tungsten or molybdenum were fabricated by cold-pressing and sintering mixed powders and by hot isostatic compaction of metal-coated UN particles. The effects of powder particle size and sintering conditions (time, temperature, and atmosphere) on the microstructure and density of cermets containing 50 volume percent UN were studied. Some sintered cermets were further densified by hot pneumatic impaction. Spherical UN particles coated with W or Mo were consolidated by hot isostatic compaction to produce dense cermets containing from 50 to 70 volume percent UN. Author

N69-21432# Rensselaer Polytechnic Inst., Troy, N. Y.
SUPPRESSION OF THE SEMICONDUCTOR-METAL TRANSITION IN VANADIUM OXIDES
T. N. Kennedy and J. D. Mackenzie Dec. 1968 14 p refs
(Contract N00014-68-A-0117)
(AD-681874; TR-1) Avail: CFSTI CSCL 11/6

V_2O_3 and VO_2 films have been sputtered by a radio-frequency technique onto relatively cold substrates. The films were amorphous according to x-ray diffraction. Their electrical resistivities at 100C corresponded to that of the respective high temperature phases of the crystals. However, unlike the crystalline solids, the amorphous films did not exhibit the so-called semiconductor-metal transition. At 25C, because of the absence of this transition, the conductivity of amorphous VO_2 is almost four orders of magnitude greater than that of the crystal. Author (TAB)

N69-21508# Brown Univ., Providence, R. I.
INVESTIGATION OF THE ROLE OF THE INTERFACE IN COMPOSITE MATERIALS Final Report
Marc H. Richman and Robert D. French Watertown, Mass. Army Mat. and Mech. Res. Center Dec. 1968 39 p refs
(Contract DAAG46-68-C-0036)
(AD-681935; AMMRC-CR-68-13(F)) Avail: CFSTI CSCL 11/4

The role of the interface in composite materials has been investigated to determine the nature of bonding between matrix and dispersed constituents and the manner in which these bonds across the interface actually give rise to the resultant properties of the composite material. An analysis of the types of bonds formed was made and atomistic models are proposed for the various layers of atoms across the interface. The role of the intermediate layers in bonding between metals and ceramics is discussed and a model presented to explain the experimental observations. Author (TAB)

N69-21510# Metaalinstituut TNO, Delft (Netherlands).
EFFECTIVENESS OF VCI PAPER IN PREVENTING CORROSION [ONDERZOEK VAN HET CORROSIEWERENDE GEDRAG VAN VCI-PAPIER]
25 Nov. 1968 8 p In DUTCH
(M68-905; TDCK-52594) Avail: CFSTI

Seven different types of paper were tested for their corrosion-preventing properties when in proximity or in direct contact with the following metals or alloys: copper, brass 63, a Cu–Sn bronze, aluminum, lead, nickel (on steel), tin (on copper), cadmium (on steel), and zinc (on steel). The results are tabulated and briefly discussed in this report. Transl. by K.W.

N69-21511# IIT Research Inst., Chicago, Ill. Dept. of Metallurgical Engineering.
THE ROLE OF CONTAMINATION IN THE KINETICS OF OXIDE NUCLEATION OF TUNGSTEN AND MOLYBDENUM
Scott Hoover, Doyle Rausch, and Paul Gordon Jan. 1969 39 p refs
(Contract Nonr-1406(10))
(AD-681712; TR-2) Avail: CFSTI CSCL 11/6

The field emission microscope was used to study the influence of foreign gases on the initial oxidation stages of molybdenum and tungsten. The technique was based on the known field enhancement effect exhibited by oxide microcrystals, allowing detection following their nucleation. Reactions were studied in pure oxygen and in oxygen mixtures at oxygen partial pressures of from 1.0 x 10 to

the minus 7th power to 0.00001 torr. Substrate temperatures of molybdenum ranged from 380C to 755C, and for tungsten, from 670C to 980C. Effects of the presence of carbon monoxide were investigated with molybdenum, and of carbon monoxide, nitrogen, carbon dioxide and methane with tungsten. Author (TAB)

N69-21544# Council for Scientific and Industrial Research, Pretoria (South Africa).

THE MODULUS OF ELASTICITY AND DAMPING AND THEIR DEPENDENCE ON THE STATE OF THE MATERIAL [ELASTIZITAETSMODUL UND DAEMPFUNG IN ABHANGIGKEIT VOM WERKSTOFFZUSTAND]

F. Foerster et al 1968 36 p refs Transl. into ENGLISH from Z. Metallik. (Stuttgart), v. 29, no. 4, 1937 p 116–123
(Ref-696) Avail: CFSTI

An acoustic technique is described which eliminates additional influences caused by plastic deformation during damping measurements. A testing method free from these effects is particularly important in measurements of strongly damped materials. Using this method, the modulus of elasticity and the damping of pure metals and various alloys were determined on test bars in a state of free transversal vibration. It was found that the modulus of elasticity decreases gradually with temperature, then shows a sharp decrease as the temperature continues to rise; the damping characteristics of the material increase with rising temperature in the same manner, as long as the slip mechanism remains unchanged. In the case of a polymorphic transformation or a transition from the ordered to the disordered state, the modulus of elasticity changes according to the transition from one state to the other, but the damping increases in the transformation zone. The ferromagnetic state has an added effect on the damping value. Various forms of tempering and mechanical stress are discussed as to their effects on the elasticity and damping of given materials; these include cold deformation; heat, tensile and hardness stresses; and different types of cavities. A.C.R.

N69-21557# Metaalinstituut TNO, Delft (Netherlands).

STUDY OF THE EFFECTIVENESS OF TEMPORARY PRESERVATIVES FOR PREVENTING CORROSION (SECOND REPORT) [ONDERZOEK NAAR HET CORROSIEWERENDE GEDRAG VAN TIJDELIJKE PRESERVEERMIDDELEN (TWEEDE RAPPORT)]

J. W. Boon 21 Nov. 1968 26 p In DUTCH
(M68-879; TDCK-46171B) Avail: CFSTI

Seven preservatives were examined in tests involving indoor and outdoor exposures as well as accelerated methods. Two of the preservatives were contained in volatile liquids and remained as films after application, one was a bitumen product contained in a special benzene, one was a vaseline, one was a stiff plastic substance, and two were paints. Ground and polished plates of rolled steel were used as test specimens. Three accelerated test methods were employed: submersion in a 3.5% NaCl solution, salt spray, and exposure to a SO_2 atmosphere. This report describes the test methods and the materials in detail. The results are presented in tables. Transl. by K.W.

N69-21558# Metaalinstituut TNO, Delft (Netherlands).

METALLOGRAPHIC STUDY OF CRACK FORMATION IN A FORGED ALUMINUM SUBSTRUCTURE OF AN S-2A AIRCRAFT (NUMBER A68/KM/066) [METALLOGRAFISCH ONDERZOEK NAAR DE SCHEURVORMING IN EEN GESMEED ALUMINIUM ONDERDEEL VAN EEN S-2A VLIEGTUIG (NUMMER A68/KM/66)]

H. R. Schotborgh and P. Breedveld 29 Aug. 1968 8 p In DUTCH
(M68-852; TDCK-51801-III) Avail: CFSTI

The crack formation occurred around the steel bushings for the shimmy damper attaching lugs on the outer cylinder nose strut, all part of the aircraft's landing gear. The aircraft had been in service for 12 years. The part was forged from the high-strength aluminum alloy 14S–T6, which contains copper, silicon, manganeses, and magnesium. A microscopic study and a Vickers hardness test were conducted. It was determined that the intercrystalline cracks were caused by stress corrosion. Transl. by K.W.

N69-21580# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.

A STUDY OF A LIQUID IMPREGNATED DISCONTINUOUS FILAMENTARY COMPOSITE METAL SYSTEM: ALUMINUM ALLOYS-RENE 41

Joseph H. Mulherin Nov. 1968 25 p refs
(AD-681974; FA-M68-40-1) Avail: CFSTI CSCL 11/4

The report discusses a discontinuous filamentary composite metal system composed of a nickel based superalloy (Rene 41) wire in an aluminum alloy matrix. As the fabrication method, liquid metal impregnation was used. Studies were made on wetting and reactivity, matrix ductility, and aspect ratio. Observations are presented on the mechanical behavior as a function of these system parameters. Author (TAB)

N69-21595# National Physical Lab., Teddington (England). Div. of Materials Applications.

PRECISE MEASUREMENTS OF ELASTIC CONSTANTS OF COPPER AND SILVER BASE ALLOYS

L. M. T. Hopkin, H. Pursey, and M. F. Markham Apr. 1968 26 p refs
(NPL-Mat-App-3; NPL-DMA-7; NPL-B-372) Copyright. Avail: CFSTI

Measurements were made by resonance and pulse ultrasonic methods on the alloys mostly in polycrystalline form but some as single crystals. Corrections were made for slightly preferred orientation which produces large errors. The overall accuracy was about 0.1%. All solutes decreased the moduli with the exception of nickel additions to copper which produced an increase. The changes were linearly related with concentration, with the possible exception of the C_{44} constant for Cu-Ga alloys, and were associated more with corresponding lattice parameter changes than with electron concentration or ion-ion interactions. Author (ESRO)

N69-21619# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.

THE EFFECT OF PRIOR-AUSTENITE GRAIN-SIZE ON THE STRESS-CORROSION CRACKING SUSCEPTIBILITY OF A.I.S.I. 4340 STEEL Final Report

R. P. M. Procter and H. W. Paxton Jan. 1969 40 p refs Submitted for publication
(Contract Nonr-760(31); ARPA Order 878)
(AD-682219) Avail: CFSTI CSCL 11/6

Using both conventional heat-treatments and repeated rapid austenitising and quenching heat-treatments, a series of AISI 4340 steels with prior-austenite grain-sizes covering the range ASTM 7-12 were developed. The stress-corrosion cracking susceptibility of the steels in a 3.5% aqueous solution of NaCl was investigated using fatigue-precracked, plane-strain cantilever-beam specimens. The results of an electron fractographic investigation of the stress-corrosion fracture surfaces are described; the experimental results are interpreted in terms of a hydrogen-embrittlement mechanism of slow crack growth. Author (TAB)

N69-21677# European Atomic Energy Community, Ispra (Italy).
TREATMENT OF ZIRCONIUM ALLOY SURFACES WITH OXIDIZING SALTS. COMPLEMENTARY STUDY ON THE BEHAVIOR OF ZIRCALOY IN CHLORINATED TERPHENYLS [TRAITEMENT DE SURFACE D'ALLIAGES DE ZIRCONIUM PAR LES SELS FONDUS OXYDANTS. ETUDE COMPLEMENTAIRE SUR LA TENUE DU ZIRCALOY AU TERPHENYLE CHLORE]
C. Hardy-Grena 1968 4 p refs In FRENCH
(EUR-3476.f-ADDEND-1) Avail: CFSTI

A systematic study was carried out on zircaloy in the presence of demineralized water, water with added chlorine, HCl, terphenyl, and terphenyl plus CCl_4 at 400°C. The experiments were conducted to provide further clarification of the mechanism of corrosion of chlorinated terphenyl on superficially oxidized zircaloy. In conclusion, the corrosion of the treated zircaloy occurred in three stages: (1) The reduction induced by hydrogen from the radiopyrolysis of terphenyl is somewhat arrested by the superficial oxide layer. (2) The reduction in the presence of chlorine and in the absence of carbon does not change the weight or appearance of the zircaloy. (3) Reduction in the presence of chlorine and carbon occurs very rapidly; the oxide layer affords no protection, carbon catalyzes chlorination. (See N67-35272.) Transl. by B.P.

N69-21703# Naval Research Lab., Washington, D. C.
ARPA COUPLING PROGRAM ON STRESS-CORROSION CRACKING Quarterly Report
E. P. Dahlberg Nov. 1968 103 p refs
(ARPA Order 878)
(AD-681727; NRL-MR-1941; QR-7) Avail: CFSTI CSCL 11/6

A progress report of the research investigations being carried out on the problem of stress-corrosion cracking of high strength materials. Work concerning test techniques, materials characterization, physical metallurgy, surface studies, and corrosion fatigue is described. The report is divided into three main sections covering work on high strength titanium, steel, and aluminum. Author (TAB)

N69-21709# Metaalinstituut TNO, Delft (Netherlands).
HOT PHOSPHATE STUDY. PART 8: RESULTS OF CORROSION TESTS [SPEURWERK WARM FOSFATEREN. DEEL VIII: AANVULLING RESULTATEN CORROSIEBEPROEVING
2 Jan. 1969 4 p In DUTCH
(M68-991; TDCK-52556) Avail: CFSTI

Additional results are presented of corrosion tests with specimens that were phosphatized, coated or treated with various materials or by different methods, and exposed to the outdoor atmosphere for two years. The order of effectiveness of the various coatings is also indicated. For full information on treatment of specimens, see N67-34120. Transl. by K.W.

N69-21760# Westinghouse Research Labs., Pittsburgh, Pa.
TWINNING AND THE LOW TEMPERATURE MECHANICAL PROPERTIES OF POLYCRYSTALLINE NIOBIUM, MOLYBDENUM AND NbMo ALLOYS
B. J. Shaw 31 Jan. 1969 40 p refs
(Contract Nonr-4442(00))
(AD-681864; Rept-69-9J7-119-R1) Avail: CFSTI CSCL 11/6

Mechanical tests in compression and tension over a range of temperatures embracing the ductile-brittle transition temperature have been done on irradiated and non-irradiated molybdenum and three alloys of niobium-molybdenum. Stress-relaxation tests in conjunction with these have been interpreted to show that gross slip and twinning are not involved in the initiation of fracture in those brittle materials. It is also deduced that irradiation damage and alloying act in a similar manner in inhibiting slip and twinning. It was concluded that the propagation energy is a predominant factor in twinning. Author (TAB)

N69-21788# Naval Ship Research and Development Center, Annapolis, Md. Materials Lab.
A STATISTICAL ANALYSIS OF HOT-CORROSION TESTS OF SOME EXPERIMENTAL AND COMMERCIAL SUPERALLOYS
R. Field, D. J. Fisk, and H. van E. Doering Jan. 1969 46 p refs Presented at the Met. Soc. of the AIME, New York, 16 Oct. 1968
(AD-681745; MATLAB-243; NSRDC-2833) Avail: CFSTI CSCL 11/6

The use of gas turbines in marine power plants depends in part on the development of superalloys which not only possess high temperature mechanical properties but also resist the corrosive effects of sea salt. A total of 137 experimental and commercial superalloys, both nickel and cobalt based, were exposed in burner rigs where controlled amounts of sea salt were added to the combustion products of sulfur-containing diesel fuel; test temperatures ranged from 1600 to 2125F; times ranges from 66 to 100 hours with 200 parts per million, and from 489 to 1100 hours with 5 parts per million salt. Corrosion was measured by recording both surface loss and maximum penetration. Author (TAB)

N69-21821# California Univ., Berkeley. Lawrence Radiation Lab.
STRUCTURAL OBSERVATIONS IN A METASTABLE AUSTENIC STEEL
James A. Hall (M.S. Thesis) Jun. 1968 69 p refs
(Contract W-7405-eng-48)
(PB-180833; UCRL-18282) Avail: CFSTI CSCL 11/6

A metastable austenitic steel showed a very favorable response to a thermomechanical treatment consisting of deformation at an elevated temperature. In room temperature tensile tests, this processed austenitic steel shows large increases in yield and tensile strengths while still exhibiting uniform elongations of 40% or more. These favorable properties arise as a result of a strain induced martensite transformation. This thermomechanical treatment (called TRIP) is described and the room temperature tensile properties are given. Some structural observations with regard to microstructure and the strain induced martensitic transformation are made with some analogies to the ausforming process being described. Author (USGRDR)

N69-21822# Royal Inst. of Tech., Stockholm (Sweden).
THEORETICAL ANALYSIS OF THE DESIGN OF MECHANICAL HAMMERS FOR HIGH-VELOCITY HOT FORGING
Shyam Kinkar Samanta 1968 26 p refs *Its* Acta Polytech. Scand., Mech. Eng. Ser. 39
(PB-180791) Avail: CFSTI CSCL 13I

Mechanical hammers for metal-working operations have a hammer assembly or tup which is accelerated by steam or air pressure or by free fall. At the moment of impact the kinetic energy of a hammer of mass m travelling at velocity sub o will be 1/2mv sub o sq. Ideally, this energy should be completely utilized in deforming the work piece; this would require both the hammer and anvil to be rigid and unyielding, conditions that are closely approached in hot-working operations. However, the effect on the metal being forged is dependent on the relative velocity and displacement at the center of the tup and anvil. For the purpose of calculating the efficiency, therefore, it is necessary to know the effect of the relative velocity produced by the force acting between the tup and anvil, the ratio of the masses of the tup and anvil, the spring constant, and finally, the damping coefficient. Author (USGRDR)

N69-21873# Martin Co., Denver, Colo. Center for High Energy Forming.
CENTER FOR HIGH ENERGY FORMING Annual Report, Aug. 1968
Jimmy D. Mote Aug. 1968 361 p refs Prepared in cooperation with Denver Univ., Colo.
(Contract DA-19-066-AMC-266(X))
(AD-681928; CR-65-77-3; ARMA-CR-68-05/15; AR-3) Avail: CFSTI CSCL 13/8

Explosive forming of domes from flat circular blanks; Numerical solution for membrane deformation in the hydrostatic bulge test; Advances in the theory of explosive metalworking; Experimental determination of dynamic stress-strain relationships. TAB

N69-21888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF THE NIOBIUM–ZIRCONIUM–HAFNIUM–CARBON SYSTEM
T. F. Fedorov et al Jul. 1968 19 p refs Transl. into ENGLISH from the book "Eksperimentalnaya Tekhnika i Metody Vysokotemperaturnykh Izmerenii" Moscow, 1966 p 127–135
(AD-682106; FTD-HT-23-334-68) Avail: CFSTI CSCL 11/6

The phase relationships in the system Nb-Zr-Hf-C were investigated. Phase diagrams based on x-ray and metallographic data are presented. The phase composition of the ternary systems Zr-Nb-C and of the binary system ZrC-HfC, were determined. The results are tabulated. TAB

N69-21906# Finnish Academy of Technical Sciences, Helsinki.
SMALL ANGLE BOUNDARIES AND DYNAMIC RECOVERY IN ALUMINUM MAGNESIUM ALLOYS
V. K. Lindroos (Ph.D. Thesis—Tech. Univ., Helsinki) 1968 52 p refs *Its* Acta Polytech. Scand., Chem. including Met. Ser. No. 76
(PB-180784; APS-Ch-76) Avail: CFSTI CSCL 11F

This dissertation summarizes and completes the previous publications listed below. Principal aspects to be covered are the formation of small angle boundaries and dynamic recovery which were found to be closely connected. The main emphasis is laid on (1) completion of the discussion of knitting of dislocation networks on several types of forests under different solidification conditions in face-centered cubic crystals, and (2) the characteristic feature of dynamic recovery, *i.e.* annihilation of both vacancies and dislocations. Additionally, the advantage of the moire technique for the study of misorientation as well as misfit across small angle boundaries is introduced. Finally, some remarks are made concerning the validity of the knitting mechanism to explain certain other phenomena, as for example creep and annealing recovery. Author (USGRDR)

N69-21918# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF ADDITIONS OF VARIOUS ELEMENTS OF THE MECHANICAL PROPERTIES OF CAST ALUMINUM ALLOYS
V. P. Perminov and B. B. Gulyaev Jan. 1968 13 p refs Transl. into ENGLISH from Mekh. Svoystva Litogo Metalla, Tr. Soveshch. (Moscow), 1963 p 259–264
(AD-682109; FTD-MT-24-375-67) Avail: CFSTI CSCL 11/6

The effects of addition of alloying elements to pure aluminum aluminum-silicon and aluminum-magnesium alloys were studied. A total of 24 addition elements were examined and the mechanical properties for each alloy were determined. TAB

N69-21930# Institute of Technology, Helsinki (Finland).
STRESS-INDUCED STACKING FAULTS IN ALPHA Cu–Al ALLOYS
Aulis V. A. Searinen (Ph.D. Thesis) 1968 85 p refs *Its* Acta Polytech. Scand., Chem. Met. Ser. No. 77
(PB-180785; APS-CH-77) Avail: CFSTI CSCL 11F

A study has been made to determine the mechanisms by which stress-induced stacking faults are generated in alpha–Cu–Al alloys. The overshoot phenomenon observed in single crystal tensile tests has been studied in order to elucidate the influence of stress-induced stacking faults upon this phenomenon. Observations have also been made of the thermal annihilation of stacking faults and of solute segregation into stacking faults. Finally, the effect of stress-induced stacking faults upon the transcrystalline stress corrosion failure has been studied. Conventional metallographic methods, such as optical microscopy, hardness measurements and X-ray diffraction, have been used, but the primary research tool has been transmission electron microscopy. Author (USGRDR)

N69-21931# California Univ., Berkeley. Lawrence Radiation Lab.
STRUCTURE AND PROPERTIES OF DYNAMICALLY STRAIN-AGED STEELS
Elliot W. Page (M.S. Thesis) Jun. 1968 77 p refs
(Contract W-7405-ENG-48)
(PB-180852; UCRL-18244) Avail CFSTI CSCL 11F

The effect of dynamic strain aging (deformation during aging) upon the mechanical properties and microstructure of Fe–3.5%Cr–0.2%C and Fe–3.5%Mo–0.2%C alloys was investigated. Dynamic strain aging resulted in a general increase in strength of 10–20% in both alloys with little or no loss in ductility. The mechanical properties were correlated with the observed microstructure using electron microscope techniques. The principal strengthening mechanism in both alloys was found to be due to the increase in dislocation density. Additional strengthening in the Fe–Mo–C alloy was attributed to the deformation enhanced formation of molybdenum carbide. Author (USGRDR)

N69-21933# Institute of Technology, Helsinki (Finland).
THE OCCURRENCE OF MASSIVE FERRITE IN THE HEAT AFFECTED ZONES OF SOME WELDED HIGH-STRENGTH STRUCTURAL STEELS CORRODING IN SEA WATER
R. Raty, V. O. Valanti, E. Rasanen, and H. M. Miekk-Oja 1968 22 p refs *Its* Acta Polytech. Scand., Chem. Met. Ser. No. 78
(PB-180786; APS-CH-78) Avail: CFSTI CSCL 11F

Heavy local corrosion has been reported to occur close to welding joints in high-strength structural steels when used without protection in sea water. Such corrosion damage has been investigated in detail in several steels where high strength combined with weldability is aimed at by means of high manganese and low carbon contents. To obtain additional information on the phenomenon, the zones affected by welding heat in these steels were studied by the authors in an electron microscope. The results, on which a preliminary report is given below, indicate that the heavily corroding areas in the heat affected zones consist predominatingly of massive ferrite. Author (USGRDR)

N69-21946# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW METAL ALLOYS
E. M. Savitskii May 1968 72 p refs Transl. into ENGLISH of Novye Metallicheskie Splavy (Moscow), 1967 p 1–48
(AD-681596; FTD-MT-24-395-67) Avail: CFSTI CSCL 11/6

The article is a review of all information thus far acquired on the overall subject of new metallic alloys. Individual sections are devoted to rare metals and alloys, single crystals, a description of zone refining techniques, rare earth metals, metallic compounds, superconducting compounds and alloys, concluding with a discussion of polymorphism in metals. Its purpose is to review post World War II developments in these fields achieved by Soviet science and

industry and to call the attention of all scientists to the necessity of further coordination of efforts to solve problems still remaining.
Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-20709# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMER MATERIALS IN ENGINEERING, INDUSTRY, AND CONSTRUCTION
M. M. Koton May 1968 25 p refs Transl. into ENGLISH from Novye Materialy v Tekhn. i Nauke: Proshloe, Nastoyashchee, Budushchee (Moscow), 1966 p 170-187
(AD-681380; FTD-HT-23-215-68) Avail: CFSTI CSCL 13/3

A brief literature survey covering the present state of polymer plastics development is presented. The following topics are discussed: a short historic survey; polymers for producing fibers; chemically stable polymers (penton, polyvinyl chloride, polyethylene, polypropylene, teflon, polyformaldehydes, polycarbonates); high temperature polymer materials (polymers of organosilicon compounds, polyorganometallo siloxanes, polymers of elementary organic compounds, complex polymer compounds, inorganic polymers, high temperature films and fibers); organic semiconductor materials.
Author (TAB)

N69-20729# Harry Diamond Labs., Washington, D. C.
BONDING OF FLUID AMPLIFIER SYSTEMS WITH A DRY-FILM ADHESIVE
Timothy J. Kilduff and Eleanor F. Horsey Oct. 1968 30 p refs
(AD-681250; HDL-TR-1419) Avail: Issuing Activity CSCL 13/7

The report describes an improved system for bonding and sealing fluid amplifiers. The principal feature of the new system is an experimental dry-film adhesive, which consists of a plastic support film coated with a nontacky epoxy resin adhesive; this film is die-cut to shape and cured in place between the amplifier halves. A secondary feature is an adhesive gasket of a commercial foamable epoxy resin designed to seal the connector tubes in place. Bonding and sealing are done simultaneously, which also represents an advance in the state of the art. Author (TAB)

N69-20741 Case Western Reserve Univ., Cleveland, Ohio.
THE DEFORMATION OF CRYSTALLINE POLYMERS
Kevin Joseph O'Leary (Ph.D. Thesis) 1967 204 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-10174

A study of the deformation process in bulk and thin films of polyoxymethylene (POM) indicates that the mode and type of deformation in these crystalline materials is a function of the sample size, particularly in thin films. The homogeneous deformation of bulk POM is followed throughout its many stages to the final fiber formation, as various areas within the spherulite react to tensile stress. In regions of intermediate draw, the lamella and the c axis of the unit cell assume a preferential orientation at ± 30° to the draw direction. With increased draw, the ultimate fibrous state is achieved, as blocks, which retain many of their original folds, are pulled out of the lamella. Results of the investigation into the interior morphology of various polymers via three basic etching techniques are presented. Dissert. Abstr.

N69-20769 Ohio State Univ., Columbus.
THERMAL DEFORMATION OF GLASS-CRYSTAL SYSTEMS
David Fred Thompson (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-12879

A review was made of the literature concerned with deformation of materials, and methods of viscosity determination. The design and construction of an apparatus to determine viscosity of a material by measuring the deflection of a simple beam is discussed. The effects of particle size, particle shape, and particle concentration on the deformation behavior of glass-crystal composites was investigated. A general equation for the deformation of glass-crystal composites is presented. Deformation behavior can be predicted based on known properties of the glassy phase, volume percent of crystalline content, and empirical coristants for the particular glass-crystal system. The activation energies for viscous flow of the composites tested are presented. It is shown that activation energy decreases as volume percent crystalline content increases. Dissert. Abstr.

N69-20790*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
LOW-DENSITY FOAM FOR INSULATING LIQUID-HYDROGEN TANKS
Irving E. Summer Washington Mar. 1969 52 p refs
(NASA-TN-D-5114) Avail: CFSTI CSCL 11I

A lightweight polyurethane foam insulation for liquid hydrogen tanks of space vehicles was developed that (1) could be foamed in place, (2) did not crack when chilled to liquid hydrogen temperature, and (3) had a thermal conductivity of 0.0137 W/(m)(K) (0.0079 Btu/(hr)(ft)(°R) at a mean temperature of 136 K (243° R). The foaming-in-place technique in which the foam constituents were poured directly on the tank, coupled with the specific foam formulation, produced a 34.4-kg/m^3 (2.14-lb/ft^3) density foam that remained structurally intact during all simulated ground-hold, vibration, and space-hold tests conducted. Thermophysical properties of the foam were determined, and thermal stress profiles throughout a layer of insulation were calculated. Author

N69-21005# Library of Congress, Washington, D. C. Aerospace Technology Div.
PREPARATION AND PURIFICATION OF SILICON CARBIDE
31 Mar. 1969 20 p refs
(ATD-68-86) Avail: CFSTI

An annotated bibliography on the preparation and growth of single crystals, and thin films for semiconductor devices is presented. Problems pertaining to purity, chemical analysis, and starting materials for silicon carbide are also listed. Entries are arranged in alphabetical order. Author

N69-21032 New York Univ., N. Y.
THE MECHANICAL AND ELASTIC PROPERTIES OF LEAD-BORATE GLASSES AT 77 DEG K AND 293 DEG K
Matthew Ciesla (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-11782

Lead-borate glasses containing 60, 70, 80, and 90 percent PbO were prepared by casting. The specimens were studied at both room temperature and while immersed in liquid nitrogen. Properties which were determined include modulus of rupture, modulus of elasticity, shearing modulus of elasticity and impact strength. Dissert. Abstr.

N69-21033 Wisconsin Univ., Madison.
DIFFUSION OF RADIOACTIVELY TAGGED HYDROCARBONS IN RUBBER-LIKE POLYMERS
Stephen Pokwok Chen (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-9066

The diffusion coefficients of radioactively tagged cetane and dodecane in trace amounts have been measured by the thin smear method in natural rubber, several polybutadienes of widely different microstructures, random and block styrene-butadiene rubbers, polyisobutylene, and polydimethylsiloxane. The theoretical equation of diffusion, expressing the time rate of change of activity detected by a Geiger–Müller counter, was evaluated numerically for cases of thin samples when the β-radiation absorption correction becomes important. Experimental data were fitted graphically to the theoretical equation, and the diffusion coefficients of the diffusant in the respective polymers were calculated. A free volume theory of diffusion was derived. Dissert. Abstr.

N69-21056 Clarkson Coll. of Technology, Potsdam, N. Y.
LIGHT SCATTERING STUDIES OF SYNTHETIC POLYMER LATEX SYSTEMS
Thomas P. Wallace (Ph.D. Thesis) 1968 287 p
Avail: Univ. Microfilms: HC $13.05/Microfilm $3.70 Order No. 68-11777

The conformity of polymer latex samples to the assumptions of Mie theory is assessed from various experiments. Particle size analyses of synthesized latex samples as well as commercial samples are carried out by a number of light scattering techniques. The effects of alteration of the type of monomodal distribution and the effects of bimodal distributions on particle size analyses are investigated. An evaluation of light scattering methods for particle size analysis of polydispersed systems is also given. Dissert. Abstr.

N69-21173*# Northrop Corp., Palos Verdes Estates, Calif. Nortronics Div.
PLASTIC AND ELASTOMERIC FOAM MATERIALS
Benjamin Arden [1966] 186 p refs
(Contract NAS7-430)
(NASA-CR-100463) Avail: CFSTI CSCL 11I

The use of plastic and elastomeric foams in the design and development of structures and components in many areas of technology in the NASA space program is discussed. The areas of technology for which foam materials were investigated are the use of foams as (1) structural components for cavity filling, space shelters, and survival equipment, (2) ablators for thermal protection of reentry vehicles, (3) cryogenic insulation of launch vehicles, (4) electrical encapsulation for low voltage and high voltage circuits, and (5) man–vehicle–environment interfaces involving personnel protection against hazards of force environments and the toxicology potential of space cabins. B.G.D.

N69-21214# Ministry of Technology, London (England).
SURVEY OF GLASS MATERIALS IN MICRO-ELECTRONICS
S. M. Cox Sep. 1968 44 p refs
(D.MAT-154) Avail: CFSTI

The purpose of this survey is to review the glass materials available for use in the field of micro-circuit production, to review current literature as an indication of future potential and to suggest where further studies are to be recommended. Author (ESRO)

N69-21241# European Atomic Energy Community, Petten (Netherlands). Joint Nuclear Research Center.
A MICROGRAPHIC STUDY OF CARBONIZATION AND GRAPHITIZATION OF AN EXTRACTED COAL TAR PITCH
J. L. White, J. Dubois, and C. Souillart 1969 24 p refs
(EUR-4094.e) Avail: CFSTI

Polarized-light micrography has been employed to investigate the microstructures formed in the carbonization and graphitization of a coal-tar pitch from which the insoluble particles have been removed by solvent extraction. Prominent features in the polarized-light extinction contours are the nodes and crosses, which are identified as four types of linear defects in the stacking of the aromatic layer planes. The coalescence process produces mostly cross-type stacking defects, but the deformation of the plastic mesophase caused by the percolation of gas bubbles results in an abrupt increase in the number of stacking defects and the formation of highly oriented regions with many folds in the layer planes. The principal effects of further heat treatment may be summarized as hardening and formation of shrinkage cracks, fold-sharpening, and finally the formation of mosaic blocks and kinks. By relieving boundary restraints and providing void space for small displacements of bulk material, the process of shrinkage cracking appears to be an essential precursor to fold-sharpening. In this latter process, the curved layer planes in the folds adjust to form sharp and approximately linear boundaries which may be twin boundaries in the ideal case. At temperatures near 3,000°C, mosaic blocks and kinks are formed on a fine scale as the final step in graphitization. Author

N69-21285 Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft.
GUIDE FOR THE SPECIFICATION, TESTING AND INSPECTION OF GLASS REINFORCED POLYESTER STRUCTURES IN SHIPBUILDING [RICHTLIJNEN VOOR SPECIFICATIES EN KEURINGEN VAN CONSTRUCTIES IN DE SCHEEPSBOUW VERVAARDIGD VAN GLASGEWAPEND POLYESTER]
G. Hamm (Kunststoffen En Rubber Inst. TNO Delft, Netherlands) Sep. 1968 35 p refs In DUTCH; ENGLISH summary
(REPT-175) Copyright. Avail: Issuing Activity

The nature and production methods of glass reinforced polyesters cause, depending on the starting points chosen, a variety of properties of the final result. This report gives some guidance in drawing up specifications and testing procedures tuned to the properties desired. For the sake of completeness attention has been paid to the basic materials and production ways and methods. Standard testing methods differ internationally. Author

N69-21355# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
PREPARATION OF TUNGSTEN CARBIDE BY ELECTRODEPOSITION
John M. Gomes and M. M. Wong Apr. 1969 16 p refs
(BM-RI-7247) Avail: Issuing Activity

The preparation of tungsten carbide by molten-salt electrolysis was investigated. Sodium tungstate in the electrolyte and carbon from the graphite anode were the source materials. Optimum results were obtained with an electrolyte consisting of 83 mole-percent sodium chloride and 5.7 mole-percent each of sodium tungstate, sodium metaborate, and sodium hydroxide; a temperature of 1,000° to 1,025° C; an anode current density of 37 amp/dm^2 or less; and an initial cathode current density of 150 amp/dm^2. The yield was approximately 0.45 g/amp hr. The electrolytic tungsten carbide product contained approximately 5.4 weight-percent combined carbon as compared to 6.1 weight-percent for pure tungsten carbide. Microhardness of the electrolytic tungsten carbide, determined with a 50-gram load, varied from 3,480 to 3,970 dph. The material was friable and could be ground in a laboratory ball mill to less than 400-mesh particle size. Author

N69-21383# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE CONSTITUTIVE ELEMENTS OF COMPOSITE MATERIALS. THEIR EFFECT ON THE MECHANICAL PROPERTIES [LES ELEMENTS CONSTITUTIFS DES MATERIAUX COMPOSITES. LEUR INFLUENCE SUR LES PROPRIETES MECANIQUES]
Arthur Kh. Iablokoff 1968 105 p ref In FRENCH; ENGLISH summary
(ONERA-NT-128) Avail: CFSTI

In this report we summarize the results obtained in fifteen years of research aiming at improving the mechanical characteristics of one-directional laminates. The causes of the decrease of the resistance of the reinforcing materials are exposed, and the optimum characteristics of the matrix are determined and evaluated. The development of the impregnation of the glass fibres led to the elaboration of the pre-stress method and to its application; but the pattern of the curves of the most resistant one-ply laminates obtained in this manner permitted the finding of insufficient interface energy-levels locally. Various methods to study the interface are described. This leads to the conclusion that an equilibrium is necessary for the following characteristics: interface energy levels, deformations at the interfaces and distribution of the matrix-reinforcing material liaisons. Author

N69-21384*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATHEMATICAL ANALYSIS OF THE FITZGERALD APPARATUS
Donald R. Behrandt and James P. Cusick Washington Mar. 1969 19 p refs
(NASA-TN-D-5116) Avail: CFSTI CSCL 11J

The machine developed by E. R. Fitzgerald to investigate the dynamic mechanical properties of solids is reanalyzed to take account of effects due to a shorted turn on the drive tube. The shorted turn arises from an extension of the aluminum portion of the drive tube into the radial magnetic field. The new analysis predicts the anomalous calibration data of the machine as well as the asymmetry and negative values of loss compliance associated with resonant phenomena. Author

N69-21484# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
CONCEPT OF AN IMPROVED TECHNICAL DIRECTIVE FOR THE PROCUREMENT OF RECLAIMED AL3 [CONCEPT VOOR EEN VERBETERD TECHNISCH VOORSCHRIFT VOOR DE AANSCHAFFING VAN AL3, GEREGENEREERD]
18 Nov. 1968 11 p In DUTCH
(TL-1968-21; TDCX-52242III) Avail: CFSTI

The AL-3 is a liquid coolant and antifreeze compound used for internal combustion engines. During the reclamation process, the percentages of the various ingredients must be assayed and replenished if necessary. The compound contains ethylene glycol, H_3PO_4, $CaC_7H_4NS_2$, and triethanolamine. This report specifies the composition as well as the methods and the equipment used in the chemical analyses. Transl. by K.W.

N69-21673*# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
INVESTIGATION OF SPACECRAFT COATINGS
R. A. Mayer, M. L. Zaring, and H. T. Kemp Huntsville, Ala. NASA. George C. Marshall Space Flight Center 11 Feb. 1969 252 p refs
(Contract NAS8-30504)
(NASA-CR-61267) Avail: CFSTI CSCL 11C

This collection contains data primarily concerning chemical, physical, and related properties of inorganic, organic, and semiorganic coating materials tested for external application on space vehicles. It also includes information such as manufacturer's designations, composition, and methods of application. Special attention was given to obtaining pertinent absorption-reflectance data and appropriate curves were included. Author

N69-21706# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
EFFECTS OF THERMAL ANNEALING AND CYCLING ON LIGHT METAL IMPREGNATED GRAPHITE
H. Burg, F. Lanza, and G. Marengo Brussels 1968 21 p refs
(EUR-4085.E) Avail: CFSTI

The effects of thermal annealing and cycling on dimensional stability of magnesium and Al/Si impregnated graphite have been studied. Dimensional increases up to 3 °/00 have been obtained. The results are discussed in terms of annealing of internal stresses due to the different thermal expansion coefficients of the two components of the material. Author

N69-21717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ADHESION OF EPOXY RESINS TO THIN STEEL WIRES
G. D. Andreevskaya et al Aug. 1968 14 p refs Transl. into ENGLISH from the book "Fiziko-Khimiya i Mekhanika Orientirovannykh Stekloplastikov" Moscow, 1967 p 95–100
(AD-681805; FTD-MT-24-239-68) Avail: CFSTI CSCL 11/4

The aim of the work was to measure the adhesional strength of epoxy polymers to thin steel wires and to investigate the influence of certain factors on the value of adhesion. For determination of adhesional strength of polymeric binding with little shrinkage a special method was developed allowing the measurement of strength of adhesional bond directly to the surface of the metallic wire. TAB

N69-21768# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
TENSILE PROPERTIES OF NEOPRENE BELOW THE GLASS TRANSITION TEMPERATURE
R. F. Robbins and R. P. Reed Repr. from Advan. in Cryogenic Eng., v. 13 1968 p 252–258 refs
(PB-180896; R-463) Avail: CFSTI CSCL 11/10

The paper describes results of tensile tests below Tg on two neoprene compounds. Some ambient temperature data are included to provide continuity with the more familiar rubber-like behavior above Tg. USGRDR

N69-21916# Technische Hochschule Munchen (West Germany).
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF RUBBER FRICTION IN A WIDE SPEED AND TEMPERATURE RANGE WITH CONSIDERATION OF FRICTION HEAT [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN ZUR GUMMIREIBUNG IN EINEM GROSSEN GERSCHWINDIGEITS UND TEMPERATURBEREICH UNTER BERUECKSICHTIGUNG DER REIBUNGSWAERME]
Hansjoerg Rieger (Ph.D. Thesis) 1968 200 p refs In GERMAN
Avail: CFSTI

Two simple models for the main components of rubber friction, i.e. for adhesion and hysteresis, are developed based on the principles of viscoelasticity. The models demonstrate the energy losses caused by friction and reflect accurately the friction behavior of the rubber. Experiments were conducted to determine the temperature increases during friction processes at high velocities. An increase in the surface temperature proportional to the square root of the sliding velocity was measured on dry surfaces. An expression for this dependence was theoretically formulated. In experiments at very low velocities in a wide temperature range, friction coefficient curves as a function of velocity were obtained for constant temperatures. The effect of friction heat in the hysteresis component was determined in experiments on lubricated surfaces. Measurements of the temperature profile in the deformed surface layer of the rubber indicate a temperature maximum below the surface. At very low temperatures, a shift of the friction coefficient curves toward lower velocities was also observed for the hysteresis component. The experimentally determined dependence of hysteresis friction are expressed in a simple statement from which formulas can be derived for the quantitative estimation of the friction coefficient if the dynamic properties of the material are known. Transl. by K.W.

N69-21938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF THE EFFECT OF ANTIOXIDANTS
M. B. Neiman and V. B. Miller Jun. 1968 38 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshch (USSR), v. 11, no. 3, 1966 p 247–261
(AD-681606; FTD-HT-23-184-68) Avail: CFSTI CSCL 11/9

A review with 88 references, through part of 1965, dealing with the physical and chemical behavior of antioxidants during aging of polymers. Special attention is devoted to org. phosphite antioxidants, as well as to stable N-oxide radicals. Author (TAB)

N69-21939# Princeton Univ., N. J. Frick Chemical Lab.
ELASTOMERIC AND MECHANICAL PROPERTIES OF POLY-M-CARBORANYLENESILOXANES. 5: THERMAL STABILITY OF SILOXANE ELASTOMERS
Montgomery T. Shaw, Albert Blachere, and Arthur V. Tobolsky Dec. 1968 13 p refs
(Contract N00014-67-A-0151)
(AD-682205; ONR-TR-RLT-112) Avail: CFSTI CSCL 11/10

The thermal stabilities of elastomers based on poly(dimethyl siloxane), poly(trifluoropropyl methyl siloxane) and poly-m-carboranyl siloxane, represented by SiB-2, were compared by the technique of chemical stress relaxation in nitrogen. Filled and unfilled elastomers were tested in the temperature range of 300-350C. The SiB-2 elastomers showed chemical relaxation times which were 50-100 times greater than the other elastomers, illustrating their outstanding thermal stability. Author (TAB)

N69-21944# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF THE ELASTIC CHARACTERISTICS OF FIBERGLASS REINFORCED PLASTICS BY THE PULSE ACOUSTIC METHOD
A. I. Potapov May 1968 27 p refs Transl. into ENGLISH from Novye Materialy v Tekhn. i Nauk. Proshloe. Nastoyashchee, Buduschchee (Moscow), 1966 p 152–169
(AD-681578; FTD-MT-24-47-68) Avail: CFSTI CSCL 11/9

A method of determining the dynamic elastic properties of fiberglasses using pulsed ultrasound is described. The method is based on measuring the propagation time of an elastic ultrasonic pulse through the material. Conventional ultrasonic equipment is used. The theoretical basis for determining the elastic characteristics of orthotropic fiberglasses by this method is formulated. Experimental tests were carried out using sheet fiberglass fabricated by the Leningrad plant for laminated plastics. The dynamic and static elastic properties are tabulated and plotted. It is concluded that the ultrasonic pulse method is reliable in determining the elastic properties and in controlling the quality of polymer materials. The elastic properties determined by the pulse method reflect the true elastic relationships between the structural elements of polymer materials. The transition coefficients can be used to evaluate the nonelastic properties of fiberglasses and of other polymer materials. The acoustic parameters and the dynamic elastic constants of orthotropic fiberglasses are accurately described by the stress-strain equations from the theory of elasticity for the anisotropic body. Author (TAB)

N69-21948# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW MATERIALS FOR HIGH-TEMPERATURE ENGINEERING APPLICATIONS
N. A. Toropov Sep. 1968 23 p Transl. into ENGLISH from Novye Materialy v Tekhn. i Nauk. Proshloe, Nastoyashchee, Budushchee (Moscow), 1966 p 107–119
(AD-681806; FTD-MT-24-271-68) Avail: CFSTI CSCL 11/9

Recent work on the development of organic silicate materials is discussed in a general way; such materials are obtained by the chemical interaction of typical organosilicon compounds of the polymer type with activated, highly dispersed silicates of the muscovite, asbestos or talcum type; or even with dispersed oxides of high temperature metals. These organic silicate products combine the elastic, moisture properties of polymers with the chemical stability and high temperature resistance of typical silicates and oxides. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-20713 Minnesota Univ., Minneapolis.
SIMPLIFICATION OF LINEAR, CONSTANT, DYNAMICAL SYSTEMS
Halbert Louis Mork (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-12274

Three detailed principal simplified mathematical models are given for describing the input–output behavior of a physical system. The first method is based on retention of the more dominant coefficient matrix eigenvalues in the simplified model. The second method exploits the interconnection structure of a special class of weakly coupled systems. The simplified system retains the dynamical property of one of the subsystems, modified to allow for the deletion of additional subsystems. The third method is based on minimization of a cost functional. The cost weights the errors between the observations and the simplified system. Investigation was limited to stable systems. A steepest descent digital computer algorithm was suggested for minimizing the cost and establishing an optimal simplified system description. Computer implementation of the first and second methods demonstrated the simplification of a flexible launch vehicle model. Rigid body dynamics, actuator and gimbal dynamics, and three bending modes comprised the system of 12 first order differential equations. Comparison of the response of the simplified systems was performed for initial conditions, controls, and disturbances. Dissert. Abstr.

N69-20735 Wisconsin Univ., Madison.
UNIVARIABLE INPUT PERTURBATION ADAPTIVE OPTIMIZATION OF SYSTEMS WITH TIME DELAY
James William White (Ph.D. Thesis) 1968 349 p
Avail: Univ. Microfilms: HC $15.79/Microfilm $4.50 Order No. 68-9148

Analysis of univariable input perturbation adaptive optimization of systems with time delay leads to system characterization by a two-constant linear retarded delay-differential equation in the time domain. Critical loop gain and system cycling frequency are determined through implicit solution of the corresponding characteristic equation in the frequency domain. The computational procedure is applicable to most optimizer and process configurations. The analysis is restricted by the assumption of quadraticity at the extremum of the unimodal response function although extension to higher order process non-linearities is considered briefly. The frequency domain model is modified through introduction of a third constant to obtain satisfactory fit of the open loop optimizer frequency response. Dissert. Abstr.

N69-20768 Indiana Univ., Indianapolis.
MULTI-VALUED MAPPINGS AND FIXED POINT THEOREMS
Michael Jerome Powers (Ph.D. Thesis) 1968 73 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-11413

The purpose of the paper is two-fold. The basic topological considerations for continuity and composition maps must be

worked out in a completely general setting. Then using this as a foundation, algebraic fixed point questions involving the use of homology groups and induced homomorphisms can be studied. A method of composing two multi-valued maps is given. When one of the maps is single-valued, the composition will be continuous. Two methods of composing with a single-valued map are presented.
Dissert. Abstr.

N69-20778 Case Western Reserve Univ., Cleveland, Ohio.
AN APPLICATION OF MONOTONE OPERATORS TO DIFFERENTIAL AND PARTIAL DIFFERENTIAL EQUATIONS ON INFINITE DOMAINS
Francois M. Perrin (Ph.D. Thesis) 1967 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-10175

A theorem on monotone operator theory, is used to show that the equation $u'' = f(x,u,u')$, $0 < X < \infty$, has a unique solution in $W_0^{1,2}(0,\infty)$, if f(x,y,z) satisfies a monotonicity condition and a nonuniform Lipschitz condition. The rate of convergence of the best approximation to the solution for different types of finite dimensional subspaces is evaluated.
Dissert. Abstr.

N69-20783# Wisconsin Univ., Madison. Mathematics Research Center.
REGULAR PERTURBATION FOR A TURNING POINT PROBLEM
Po-Fang Hsieh Sep. 1968 40 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681407; MRC-TSR-934) Avail: CFSTI CSCL 12/1

A block-diagonalization theorem for rho dy/dx = (x to the pth power A(x, epsilon) + rho B(x, epsilon))y at a turning point x = 0 is proved. Specially, this process is shown to be analytic with respect to a factor beta = rho to the power (1/(p+1)).
Author (TAB)

N69-20787*# Massachusetts Univ., Amherst. Engineering Research Inst.
EXTENSION AND APPLICATION OF A SEQUENTIAL ESTIMATOR
C. M. Brown, Jr. and R. V. Monopoli Jan. 1969 52 p refs
(Grant NGR-22-010-012)
(NASA-CR-100423; Rept-3) Avail: CFSTI CSCL 12A

This thesis extends and applies a particular sequential estimation technique. First a method is presented to increase the accuracy of the estimator, given bounds on the measurement noise. Second a method is presented where some systems may be estimated adequately with a greatly simplified estimator which results in a large reduction in the amount of computation required by the estimator. Examples are discussed showing how these methods have been applied successfully.
Author

N69-20793 Yeshiva Univ., New York.
THE EVOLUTION OF THE MATHEMATICAL CONCEPT OF CONVERGENCE
Mary Carol Schommer (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-10986

The mathematical concept of convergence can be viewed in terms of a function whose domain has a binary relation that is transitive, and whose range possesses some notion of closeness. Using this function as a unifying principle, the development of the concept of convergence was traced from Greek times. The evolution of convergence was marked by progressive generalization. Frechet's work, which culminated in the definition of a metric space and a topological space, was discussed while tracing this historical evolution. The nets of Moore and Smith, the filters of Cartan, and the syntaxes of McShane were investigated in detail. A comparison of these different formulations of generalized convergence and various applications in analysis and topology were also included in the discussion.
Dissert. Abstr.

N69-20822 New Mexico Univ., Albuquerque.
STOCHASTIC LINEAR ESTIMATION IN HILBERT SPACE
Anthony Wells Warren (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-11668

In this paper a theory is developed of linear estimation in Hilbert spaces given errors in a collection of data. Roughly speaking, the theory of linear estimation in Hilbert spaces is concerned with the following type of problem: Suppose H is a Hilbert space and for some element $f \in H$ a collection of data is given which does not in general completely determine f, i.e., there is a set S contained in H which has the property that each element in S satisfies the given data. It is desired to find a "best" estimate of Af given such a collection of data, where A is a continuous linear operator defined on H. In this paper it is supposed in addition that the observed data is subject to error.
Dissert. Abstr.

N69-20836 Wisconsin Univ., Madison.
NUMERICAL METHODS FOR VOLTERRA INTEGRAL EQUATIONS WITH APPLICATIONS TO CERTAIN BOUNDARY VALUE PROBLEMS
Peter Linz (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-9098

This thesis deals with numerical methods for solving Volterra integral equations and the application of Abel integral transforms to the numerical solution of certain boundary value problems. Part A investigates the numerical solution of Volterra integral equations by finite difference methods. Numerical procedures are outlined and a number of theoretical results established. Part B deals with the application of Abel transforms to the numerical solution of several boundary value problems. Chapter I first reviews some of the methods of solving Abel integral equations. A number of experimental comparisons are given. Abel transforms are then applied to a number of problems to reduce them to a form convenient for numerical solution. The first application is to Laplace's equation in cylindrical coordinates, the second to the problem of finding the charge distribution on a charged annulus. Chapter II is a detailed investigation of the problem of finding the stresses when a cylindrical body is idented into an elastic foundation.
Dissert. Abstr.

N69-20837 Yale Univ., New Haven, Conn.
BANACH SPACES OF LIPSCHITZ FUNCTIONS OF AN ABSTRACT METRIC SPACE
Thomas Morton Jenkins (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-11197

Given a metric space (X,d) and a positive number $\alpha \leq 1$, let $\mathrm{Lip}(X,d^\alpha)$ denote the space of all bounded continuous complex-valued functions f on X such that $\mathrm{Lip}(X,d^\alpha)$ is a Banach space under the norm $\|\ \|$ given by $\|f\| = \|f\|_\infty \vee \|f\|_{\mathrm{Lip}\alpha}$. The closed linear subspace $\mathrm{lip}^\alpha(X,d^\alpha)$ consists of those f in $\mathrm{Lip}(X,d^\alpha)$ which vanish at infinity. A metric space is said to satisfy the *Lipschitz four-point property* if every complex-valued function defined on three points of X has a Lipschitz preserving extension to any fourth point of X. We show that such extensions exist for every subset and every complex-valued $f \in \mathrm{Lip}(Y,d)$ if and only if (X,d) satisfies the Lipschitz four-point property.
Dissert. Abstr.

N69-20838 Michigan State Univ., East Lansing.
STABILITY OF INTERCONNECTED SYSTEMS
Wiley Ernest Thompson (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-11101

This thesis considers the stability of several classes of interconnected systems, consisting of multiterminal, nonlinear, time-varying components. In addition to dynamic components, algebraic and algebraic-dynamic components are allowed. Scalar and vector Liapunov functions are constructed for the interconnected systems in terms of Liapunov functions of the individual components, the system structure, and a parameter vector determined in a prescribed optimal manner. Sufficient conditions for various types of stability are obtained for the identified classes of interconnected systems. The conditions are given in forms which are particularly well suited for digital computation and design. A ninth-order, nonlinear system is considered for illustration. Dissert. Abstr.

N69-20840# Wisconsin Univ., Madison. Mathematics Research Center.
CHARACTERIZATION OF THE SETS OF CONSTRAINTS FOR WHICH THE NECESSARY CONDITIONS FOR OPTIMIZATION PROBLEMS HOLD
Jean Pierre Aubin Aug. 1968 29 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681406; MRC-TSR-930) Avail: CFSTI CSCL 12/1

The necessary conditions of a problem of minimization of a convex functional on a convex subset is related to the description of this convex by a set of convex constraints. We characterize such sets for which those necessary conditions hold and give some applications. Author (TAB)

N69-20845# Wisconsin Univ., Madison. Mathematics Research Center.
PERTURBATION OF LINEAR ORDINARY DIFFERENTIAL EQUATIONS AT IRREGULAR SINGULAR POINTS
Yasutaka Sibuya Aug. 1968 23 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681403; MRC-TSR-916) Avail: CFSTI CSCL 12/1

A block-diagonalization theorem of a linear system of differential equations at an irregular singular point is proved. Such a transformation is constructed so that it admits an asymptotic representation with respect to the independent variable and parameters. Author (TAB)

N69-20858# Wisconsin Univ., Madison. Mathematics Research Center.
AN IDENTITY FOR SPLINE FUNCTIONS WITH APPLICATIONS TO VARIATION DIMINISHING SPLINE APPROXIMATION
Martin J. Marsden Jun. 1968 77 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681401; MRC-TSR-897) Avail: CFSTI CSCL 12/1

A spline function identity is developed and used to discuss the convergence properties of Schoenbergs variation diminishing spline approximation method. The Weierstrass approximation theorem is extended. Similar results for Chebshevian splines are developed. Author (TAB)

N69-20859# Wisconsin Univ., Madison. Mathematics Research Center.
A CORRESPONDENCE BETWEEN BAYESIAN ESTIMATION ON STOCHASTIC PROCESSES AND SMOOTHING BY SPLINES
George S. Kimeldorf and Grace Wahba Oct. 1968 18 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681410; MRC-TSR-947) Avail: CFSTI CSCL 12/1

The report presents classes of prior distributions for which the Bayes estimate of an unknown function given certain observations is a spline function. Author (TAB)

N69-20863# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE ASYMPTOTIC INTEGER ALGORITHM
T. C. Hu Oct. 1968 27 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681409; MRC-TSR-946) Avail: CFSTI CSCL 12/2

A new asymptotic integer algorithm is proposed which needs a fewer number of operations than Gomorys original algorithm. Author (TAB)

N69-20864# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE EQUIVALENCE OF CONDITIONS ON A BRANCHING PROCESS IN CONTINUOUS TIME AND ON ITS OFFSPRING DISTRIBUTION
Krishna B. Athreya Sep. 1968 23 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681408; MRC-TSR-936) Avail: CFSTI CSCL 12/1

The paper shows under very general conditions on a convex functions phi E phi(x(t)) < infinity if and only if Summation over j of (phi(j)p sub j) < infinity where X(t) is a continuous time branching (Markov or age dependent) process with offspring generating function h(z) = Summation from j=0 to j = infinity of ((p sub j) (z superscript j)). Author (TAB)

N69-20902# Royal Aircraft Establishment, Farnsborough (England).
THE GREEN'S FUNCTION OF THE WAVE-MECHANIC KEPLER PROBLEM [DIE GREENSCHE FUNKTION DES WELLENMECHANISCHEN KEPLERPROBLEMS]
J. Meixner Oct. 1967 44 p refs Transl. into ENGLISH from Math. Z. (Germany), v. 36, 1933 p 677–707
(RAE-Lib-Trans-1251) Avail: CFSTI

The Green's function and its development from eigenfunctions, the significance of Green's function for the continuous spectrum and wave mechanic electron flow, and its application to the one and three dimensional wave mechanic Kepler problem are defined. Integral representations, expressions for large and small values of the argument x, recurrence formulae, addition theorems, and generating functions of the degenerate (or confluent) hypergeometric function are also discussed. Author

N69-20922 Wisconsin Univ., Madison.
HOMEOMORPHIC CONTINUOUS CURVES IN 2-SPACE ARE ISOTOPIC IN 3-SPACE
William Keith Mason (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-9101

Let S and S' be continuous curves in E^2 and let g be a homeomorphism of S onto S'. Then there is a homeomorphism H of E^3 onto E^3 such that (a) H = g on S, and (b) H is realizable by an isotopy. Dissert. Abstr.

N69-20928 Stanford Univ., Calif.
ON NONSTATIONARY FOR THE NAVIER–STOKES EQUATIONS AND THE STABILITY OF STATIONARY FLOWS
John Groves Heywood (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-11307

In this paper generalized solutions of the type introduced by Kiselev and Ladyzhenskaia are obtained and studied for several

problems with nonhomogeneous boundary data. The proof of existence follows closely approaches used by Ladyzhenskaia and by Hopf. Approximate solutions of the Galerkin type are used. Then, convergence to a generalized solution depends upon establishing a priori estimates for these approximations and their first derivatives. The generalized solutions are unique and satisfy an energy equality. Their behavior as $t \to \infty$ are investigated and a discussion of their regularity is included. Dissert. Abstr.

N69-20931 Texas Univ., Austin.
RINGS OF ANALYTIC FUNCTIONS
Julianne Souchek (Ph.D. Thesis) 1968 48 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10887

If F is an open Riemann surface and A(F) is the set of all analytic functions on F then A(F) is a ring under pointwise addition and multiplication. This paper is concerned with proper subrings R of A(F) which are isomorphic images of A(G), the ring of all analytic functions on an open Riemann surface G under an isomorphism which maps each constant function onto itself. For R a proper subring of A(F) we find some necessary and sufficient conditions for the existence of a surface G such that R is isomorphic to A(G). Dissert. Abstr.

N69-20932 Case Western Reserve Univ., Cleveland, Ohio.
TRANSITION SEMIGROUP OF SEQUENTIAL DEVICES
Melvyn Harold Schwartz (Ph.D. Thesis) 1967 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-10181

Many approaches to the description and analysis of the structure of sequential and quasi-sequential devices exist. One significant technique associates a semigroup (herein called the transition semigroup) with the state transition structure of a sequential device, and relates various algebraic properties of this semigroup to internal and external characteristics of the device. This technique is applied to the study of four basic topics. A relationship is found among all such machines which accept S, and a strong characterization of the simplest machine in that class is given. A relationship is found among all such machines which compute f, and a strong characterization of the simplest machine in that class is given. A relationship between the transition semigroup of the simplest machine which computes f and the simplest acceptor accepting S(f) is found. Relationships are found between the transition semigroup of the serial or parallel connection of two machines and the transition semigroups of the component machines. Dissert. Abstr.

N69-20940*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FOURIER ANALYSIS BY THE METHOD OF SELECTED ORDINATES
James N. Hallock Washington Mar. 1969 28 p ref
(NASA-TN-D-5083) Avail: CFSTI CSCL 12A

The selected ordinate method for determining the Fourier coefficients of a periodic curve is of great use when an approximate value is desired in a very short time. Tables of the ordinates are given. Evaluation of a coefficient is reduced to a simple summation. Author

N69-20943 Auburn Univ., Ala.
CONCERNING EXPANSIVE POINT SETS AND THE EQUIVALENCE OF COVERING DIMENSION
Albert Ray Van Cleave, Jr. (Ph.D. Thesis) 1968 49 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-12324

Six notions of expansive point sets are defined. These notions are used to characterize those topological T_1 spaces which are normal, hereditarily normal, collectionwise normal, and hereditarily collectionwise normal. The equivalence of certain notions of covering dimension is shown. Dissert. Abstr.

N69-20944 Washington State Univ., Pullman.
TIME AND TRAJECTORIES IN ABSTRACT POLYSYSTEMS
Hugh Daniel Sullivan (Ph.D. Thesis) 1968 43 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10975

A polysystem is a nonempty set equipped with a quasi-order called the attainability relation. A concept of time for the polysystem can be introduced by means of a partially ordered set and an isotone function, called a clock function, which associates to each event a certain "time". It is shown that a time structure of this type can be obtained from the intrinsic structure of the polysystem in terms of a class of equivalence relations. A trajectory in a timed polysystem may be defined as an isotone mapping. The existence of trajectories is analyzed, first emphasizing the general situation where no additional structure is assumed in the timed polysystem, then in a polysystem which is assumed to be endowed with a topological structure. In the last case, necessary and sufficient conditions are obtained for the equivalence of attainability and the existence of trajectories. Dissert. Abstr.

N69-20955 Yeshiva Univ., New York.
A STUDY OF THE HISTORY AND SIGNIFICANCE OF THE CAUCHY FUNCTIONAL EQUATION
William W. Parsons (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-10983

Cauchy in 1821 provided the first general solution of the functional equation $f(x + y) = f(x) + f(y)$ under the assumption that f is continuous. In 1875 and 1880 Darboux in connection with his papers on the composition of forces and projective geometry respectively, pointed out that the solutions of this equation are continuous if either for all positive x the functional values are positive or that if in any interval the function is bounded. In 1920 Sierpinski proved that every measurable function that satisfies the Cauchy equation is continuous. Later Kestelman proved that if an additive function is bounded on a set of positive measure it is continuous. In 1905 Hamel described a basis for the real numbers in terms of which a discontinuous solution of the Cauchy equation is easily produced. Quasiconvex sets, generalizations of convex sets, have been studied by Green and Gustin, the results published in 1950. Dissert. Abstr.

N69-20994# Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.
THE SECOND VARIATION TEST WITH ALGEBRAIC AND DIFFERENTIAL CONSTRAINTS
B. Fraeijs de Veubeke [1968] 40 p refs
Avail: CFSTI

The second variation test for the algebraic constrained minimum problem can be placed in eigenvalue form by the introduction of a norm in the space of coordinate perturbations. It appears then as a Jacobi type of accessory minimum problem. A similar objective can be reached in the control problem, where the constraints are of differential type, by norming the weakly varied trajectories in the neighbourhood of the optimal. If the norm is expressed in terms of control perturbations only, the eigenvalue type of second variation test and the optimum linear feedback control problem are very closely related. The case of broken extremals is considered and solved by the use of total perturbations, involving a shift in the independant variable. The rate of shift is introduced as an additional control. The eigenvalue test remains applicable to extremals containing singular arcs and constitutes a different approach to the ones attempted previously. An example of such a case is treated in detail. Author (ESRO)

N69-21063 California Univ., Los Angeles.
THEORY FOR CRITERION FUNCTION SYNTHESIS IN DESIGN
Benjamin Ostrofsky (Ph.D. Thesis) 1968 158 p
Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-11880

The synthesis of a criterion function during the design process enabled a candidate system to be evaluated relative to others in the set of candidates. From this criterion function inference can be made concerning the performance of the optimal system. The approach used was to examine the design morphology and anatomy, transforming the performance of the set of candidate systems to a multivariate probability distribution. A description was provided of the limitations of existing goodness-of-fit tests from which inference concerning the nature of the theoretic distribution could be made. The union of the events in the multivariate space was formulated providing a means from which the maximum, feasible performance for the set of criteria to be identified. An experiment was conducted showing the statistical techniques for identifying the subject probabilities resulting from a set of observations provided by a group of designers. Dissert. Abstr.

N69-21072# National Physical Lab., Teddington (England). Mathematics Div.
PARTITION SYMMETRIES
J. M. Arrowsmith and B. R. Heap Nov. 1966 51 p refs
(NPL-MA-64) Copyright. Avail: CFSTI

Tables are presented giving the different symmetries of partition of a positive integer M into m parts. The tables are given for integers M up to 50 and for values of m up to 12 and were produced by means of a recurrence relation and a KDF9 computer. These tables were produced in connection with the enumeration of linear and multiply connected graphs. ESRO

N69-21143*# Mathematics and Biology Corp., Benton, Kans.
BOUNDEDNESS THEOREMS AND OTHER MATHEMATICAL STUDIES OF A HODGKIN–HUXLEY TYPE SYSTEM OF DIFFERENTIAL EQUATIONS: NUMERICAL TREATMENT OF THRESHOLDS AND STATIONARY VALUES
Stephen W. Brady Washington NASA Mar. 1969 130 p refs
(Contract NSR-38-080-001)
(NASA-CR-1272) Avail: CFSTI CSCL 12A

Constructed is a mathematical model for the flow of electric current through the surface membrane of membranous cells such as skeletal muscle fibers, pacemakers, receptors, and heart cells with plateau type behavior. The gross behavior of the electrical properties of these cells is simulated by parameterization and by varying the sustained constant membrane current density. The model exhibits the threshold "on–off" aspects of nerves as required depending on the numerical justification for using the steady state approximately to treat the local stimulation effects together with three subsidiary first order differential equations taken from the Hodgkin–Huxley model. G.G.

N69-21160# Wisconsin Univ., Madison. Dept. of Statistics.
SPECTRAL ANALYSIS OF A STATIONARY TIME SERIES USING INITIALLY SCARCE DATA
Henry R. Neave Mar. 1968 82 p refs Supported in part by NSF and the Sci. Res. Council of Great Britain
(PB-180935; TR-152) Avail: CFSTI CSCL 12A

The purpose of this paper is to introduce and study methods of estimating the spectrum of a stationary time series when given 'initially scarce' data, i.e. data where the sampling period is shortened at some point during the period of observation. Two types of estimate are considered, the 'basic' estimates, so-called because they derive from general theory which can essentially be applied to most missing data situations, and 'alias-improved' estimates, whose use unfortunately cannot be extended to many other situations. The estimates are compared here in finite situations by Monte Carlo methods, and the alias-improved estimates turn out to be much superior. Author (USGRDR)

N69-21161# Wisconsin Univ., Madison. Dept. of Statistics.
A COMPARISON OF LAG WINDOW GENERATORS
Henry R. Neave Apr. 1968 37 p refs Sponsored in part by NSF and the Sci. Res. Council of Great Britain
(PB-180936; TR-156) Avail: CFSTI CSCL 12A

Spectrum estimates depend for their specification on a truncation point and a 'covariance averaging kernel' or 'lag window', which is derived from a 'lag window generator'. A comparison of such generators is presented, based upon their negated derivatives, which are shown to be the approximate weightings in a particular type of representation of the spectrum estimate. It is clearly shown why the well-known generators of Parzen and Tukey are superior to most (but not all) of their rivals. These still have weaknesses however, and the paper concludes with a suggestion as to how these may be overcome. Author (USGRDR)

N69-21204 Texas A&M Univ., College Station.
CONVEX PROGRAMMING APPLIED TO THE ESTIMATION OF THE PARAMETERS OF DEFINITE QUADRATIC FORMS AND TO RELATED TESTS OF HYPOTHESES
William Peyton Cooke, Jr. (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-11448

Two related problems are considered in this dissertation. The first of these problems is the estimation of the parameters for a second-order response surface subject to the restriction that the function describing the surface is a semidefinite quadratic form. Related to this problem is a test of the hypothesis that the response surface is described by a semidefinite quadratic form. Solutions for the two problems are desirable in situations where it is either known or conjectured that the surface will have a unique extremum over a certain region. To solve the estimation problem that least squares principle is used in conjunction with a convex programming algorithm. It is shown that the subset S of the $(k+1)$-dimensional space of the β_{ij}, $i,j = 1, \ldots, K$ described by $v'Bv^2 \geq 0$ is convex. The problem is then formulated as a convex programming problem which is solved in the dual by the revised simplex method using special pricing operations. Dissert. Abstr.

N69-21234# Joint Publications Research Service, Washington, D. C.
OPTIMAL QUESTIONNAIRES WITH UNEQUAL VALUE OF THE QUESTIONS
P. P. Parkhomenko *In its* Cybernetics and Regulation Theory 11 Mar. 1969 p 5–11 refs (See N69-21232 10-05) Avail: CFSTI

Sorting, trees, and measure of order are used to obtain the value of a by-pass of a questionnaire that characterizes the average weighted expenditures on identification of the events by the questionnaire as a whole. If the value of the question is the cost or time of realization of an individual test and the weight of the event is the probability of the state of the target, then the by-pass gives the average time or average cost of determination of one state in the provisional diagnostic procedure. G.G.

N69-21240# Wisconsin Univ., Madison. Dept. of Statistics.
A FORM OF OPTIMUM WEIGHING SYSTEM FOR SPECTRUM ESTIMATES
Henry R. Neave May 1968 30 p refs Sponsored in part by NSF and the Sci. Res. Council of Great Britain
(PB-180937; TR-157) Avail: CFSTI CSCL 12A

A previous paper demonstrated some weaknesses of the usual class of estimates of the spectrum of a stationary time

series, where the weights are dependent solely on a 'lag window generator' and choice of truncation point. To pursue this matter further, an expression for the optimum weights according to the criterion of minimum average mean square error is calculated. This expression, which depends on the spectrum being estimated, is rather complicated, and two approximations to it are devised and examined. The optimum weights in certain autoregression situations are computed and compared with the weights in the standard types of spectrum estimate. Author (USGRDR)

N69-21278# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaft.

ON THE BINARY EMBEDDING OF FINITE AUTOMATA [ZUR BINAEREN EINBETTUNG ENDLICHER AUTOMATEN]

Peter Kandzia (Ph.D. Thesis) 1968 82 p refs In GERMAN
Avail: CFSTI

State-logic relations for binary imbeddings of abstract automata and subsequent technical realization are expressed in corresponding Boolean functions for the delay and shift elements. Binary codes are developed for input groupings, state groupings, and output groupings and secondary variable functions are used to establish the transfer behavior of conformal groups. Transl. by G.G.

N69-21287# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

A COMPARISON OF SOME PROCESS PARAMETER ESTIMATING SCHEMES

A. J. W. van den Boom and J. H. A. M. Melis Sep. 1968 22 p refs
(TH-68-03) Avail: CFSTI

Two basic approaches, i.e., the instrumentation of explicit mathematical relations and the model matching technique, are compared theoretically with respect to the accuracy as a function of the observation interval. In some situations both methods, each requiring matrix inversion, can sufficiently be approximated by the use of a nonorthogonal estimating scheme without matrix inversion. A summarizing discussion is given on additional errors due to the approximation of the ideal estimating procedure.

N69-21291*# Maryland Univ., College Park. Computer Science Center.

APPLICATIONS OF ALTERNATING DIRECTION METHODS TO MILDLY NONLINEAR PROBLEMS

Joseph Richard Caspar Dec. 1968 121 p refs
(Grants NGL-21-002-008; DA-ARO(D)-31-124-G676; DAHC04-67-C-0062)
(NASA-CR-73865; TR-68-83) Avail: CFSTI CSCL 12A

The solution of mildly nonlinear equations in R^n (especially those arising from the discretization of mildly nonlinear, self-adjoint, elliptic boundary value problems in two dimensions) is studied. Existence and uniqueness results are presented, and several iterative techniques for approximating the solution are considered. These techniques are generally two-level iterations in which an alternating direction procedure is coupled with a linearizing procedure, either of Picard or of the Newton type. Proofs of the convergence of these procedures are given. Author

N69-21321# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

CALCULATION OF THE BESSEL FUNCTIONS I_n, J_n, K_n AND Y_n USING CONTINUED FRACTIONS [CALCUL DES FONCTIONS DE BESSEL I_n, J_n, K_n ET Y_n MOYENNANT LES FRACTIONS CONTINUES]

R.-F. Gloden Brussels 1968 44 p refs In FRENCH; ENGLISH summary
(EUR-4191.F) Avail: CFSTI

The Bessel function I_μ, which constitutes the distinguished solution of the recurrence relation is not easily obtained by means of this relation from a certain value of n forward; but the quotient of two functions I_n of consecutive indexes is easily expressed by means of an infinite continued fraction. From this we have deduced an algorithm to calculate the functions I_n. To estimate the error, we consider the fact that the value of a continued fraction having only positive terms is included between two consecutive approximants. Furthermore we find that the relative error, which constitutes a priori a function of the abscisse x, the index n and the number of partial quotients of the continued fractions, is practically independent of n for $n \geq 10$. Therefore we have determined the number of partial quotients corresponding to the maximum relative error equal to 10^{-10}. The different errors are graphically represented. Starting from these considerations we have established subroutines in Fortran II, double precision, and in FAP, for the IBM 7090, to be used for calculating the Bessel functions I_n, J_n, K_n and Y_n, $0 \leq n \leq 50$ by means of the continued fractions. Author

N69-21324# Aeronautical Research Council (Gt. Brit.)

ASYMPTOTIC SOLUTIONS OF LINEAR STATIONARY INTEGRO-DIFFERENTIAL EQUATIONS

R. D. Milne 1968 35 p refs Supersedes ARC-28195
(ARC-R&M-3548; ARC-28195) Avail: CFSTI

A method is described for finding asymptotic solutions, valid for large time, of a certain class of linear, integro-differential equations which typically arise in the description of systems exhibiting heredity. The solutions are developed from a knowledge of the steady-state behaviour of the system, or more particularly of a part of the system, under harmonic excitation. The analysis is carried through for the particular case of a flexible aeroplane disturbed from steady, rectilinear flight but the main stream of the argument may be pursued independently of this physical framework. Author (ESRO)

N69-21365# Brown Univ., Providence, R. I.

ASYMPTOTIC BEHAVIOR OF NEUTRAL FUNCTIONAL DIFFERENTIAL EQUATIONS

Jack K. Hale and Marianito A. Cruz 1968 43 p refs
(Contract Nonr-233(76))
(AD-681064) Avail: CFSTI CSCL 12/1

A functional differential equation of neutral type is an equation for a function x in which the derivative x dot of x at time t depends not only upon the past and present values of x, but also upon the past and present values of x dot. A general class of linear functional differential equations of neutral type is defined in the space of continuous functions. For this class, a variation of constants formula is derived which gives the solution of a nonhomogeneous linear equation with zero initial data as an integral of the forcing function. It is then shown that the kernel in this integral representation can be used to obtain the general solution of the homogeneous equation. The stability properties of the solutions of the homogeneous equation are characterized in terms of the kernel in the variation of constants formula. Section 3 is devoted to the stability of solutions of equations which are linear or nonlinear perturbations of a given linear system. Author (TAB)

N69-21366# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

TWO SERVERS IN SERIES, STUDIED IN TERMS OF A MARKOV RENEWAL BRANCHING PROCESS

Marcel F. Neuts Oct. 1968 70 p refs *Its* Mimeograph Ser. No. 173
(Contract Nonr-1100(26))
(AD-681010) Avail: CFSTI CSCL 12/2

The paper discusses the transient and limiting behavior of a system of queues, consisting of two service units in tandem

and in which the second unit has finite capacity. When the second unit reaches full capacity, a phenomenon termed blocking occurs. A wide class of rules to resolve blocking is defined and studied in a unified way. The input to the first unit is assumed to be Poisson, the service times in the first unit are independent with a general, common distribution. When the system is not blocked, the second unit releases its customers according to a statedependent, death process. The analysis of the timedependence relies heavily on several imbedded Markov renewal processes. In particular, the analog of the busy period for the M/G/1 queue is modeled here as a Markov renewal branching process. The study of this process requires the definition of a class of matrix functions which generalizes some classical definitions of matrix function. In terms of these matrix functions one is led to consider functional iterates and a matrix analog of Takacs' functional equation for the transform of the distribution of the busy period in the M/G/1 model. Joint distribution of the queuelengths in units I and II and its marginal and limiting distributions are discussed. A final section is devoted to an informal discussion on how the numerical analysis of this system of queues may be organized. Author (TAB)

N69-21410# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE SIGNIFICANCE OF A STRESS PERCENTAGE OBTAINED WITH KRUSKAL'S MULTI-DIMENSIONAL SCALING TECHNIQUE
W. A. Wagenaar and P. Padmos 1968 11 p refs
(IZF-1968-22; TDCK-52598-III) Avail: CFSTI

With use of a Monte Carlo technique the probability distribution of the stress percentage is estimated for the case that n points are placed in m dimensions with the Kruskal method. The n is an integer between 7 and 12, and m ranges between 1 and 5. The result can be an aid in determining the significance of a multidimensional representation of experimental data. Author

N69-21414# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE RECOGNITION OF RANDOMNESS IN VISUALLY PRESENTED BINARY LISTS
W.A. Wagenaar 1968 9 p refs
(IZF-1968-15; TDCK-51838-III) Avail: CFSTI

Sequences consisting of 50 plus-symbols and 50 spaces printed on one line, were constructed in which the conditional probability of a plus following a plus varied from 0.2 to 0.8. In a triadic comparison experiment, these sequences were presented to eight subjects and as a result, scales were obtained on which the subjects judged the conditional probability. It was possible to find on these scales an ideal point, coincident with the subject's concept of randomness, which appeared to deviate considerably from real randomness. Author

N69-21429# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
OVERESTIMATE OF THE OPTIMUM AS A CONVERGENCE CRITERION FOR THE GRADIENT METHOD [CRITERE DE CONVERGENCE PAR SURESTIMATION DE L'OPTIMUM POUR LA METHODE DU GRADIENT]
Jean Fave 1968 18 p refs In FRENCH; ENGLISH summary
Presented at 2nd Intern. Conf. on Calculation Methods in Optimization Probl., San Remo, Italy, 9–13 Sep. 1968
(ONERA-TP-628) Avail: CFSTI

The gradient method having a very slow final convergence is presented. The recognition of a bound which is beyond the optimum permits the localization in an interval, and is used as convergence criterion for the iterative process, when the optimum has been localized with a given accuracy. The determination of this bound depends on the fact that the maximum of a function f of several variables, constrained by a relation g = 0, is smaller or equal to the maximum of the function f + λ g. The optimization of trajectories of an orbital glider reentering the atmosphere is included as an illustration. Author

N69-21504# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PATTERNS OF FAILURES
I. B. Gertsbakh and Kh.B. Kordonskii May 1968 167 p refs Transl. into ENGLISH from the Russian
(AD-682237; FTD-MT-24-391-67) Avail: CFSTI CSCL 14/4

The book presents mathematical models of failures according to their various causes. The laws of time distribution of failure-free operation are obtained. With the help of the method of moments and the method of separating the normal distribution parameters into three groups for processing experimental data, procedures for evaluating systems parameters are established. The book is intended for persons dealing with the application of the probability theory to reliability problems. TAB

N69-21549# Illinois Univ., Urbana. Coordinated Science Lab.
NUMERICAL STUDIES OF THE NONLINEAR BOLTZMANN EQUATION. PART 1: SUMMARY OF PROGRAMS AND THEORY USED IN MONTE CARLO SOLUTIONS OF THE BOLTZMANN EQUATION
Barbara J. Reilly Jan. 1969 45 p refs
(Contracts N00014-67-A-0305-0001; DAAB07-67-C-0199)
(AD-681707; R-402) Avail: CFSTI CSCL 20/13

Contents: Description of the principal computer programs; Theory and equations - Boltzmann program; Theory and equations - Averr program. Author (TAB)

N69-21560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL-PROBABLE MODELING OF RANDOM PROCESSES
A. S. Zhernenko 11 Jul. 1968 15 p refs Transl. into ENGLISH from Morsk. Sb. (Moscow), No. 11, 1965 p 32–37
(AD-682169; FTD-HT-23-101-68) Avail: CFSTI CSCL 12/1

Operational and tactical calculations, as well as scientific and technical investigations, often involve consideration of random phenomena and processes which can be characterized by statistical parameters calculated as averages of observed (selected) values. The statistical probability modeling method for random processes suggested used the Monte Carlo method as its mathematical base, and the article proceeds to describe its application to two practical examples, one of which is the calculation of the process involved in a missile closing a target; the other reproducing an actual noise process in accordance with the normal distribution law. The mathematical method described involves the use of an electronic computer to obtain the statistical evaluation of characteristics with required accuracy and to reproduce the probability models of the subjects under investigation using experimental data based on distribution laws and correlated ties in the elements of those subjects, without waiting for the development of an analytical theory and the disclosure of the physical content of those subjects. TAB

N69-21564# Wisconsin Univ., Madison. Mathematics Research Center.
FUNCTIONS OF PROCESSES WITH MARKOVIAN STATES, 2 Technical Summary Report
Martin Fox and Herman Rubin Aug. 1968 13 p refs
(Contracts DA-31-124-ARO(D)-462; Nonr-2587(02); N00014-67A-0226-0008)
(AD-681478; MRC-TSR-920) Avail: CFSTI CSCL 12/1

Conditions are given under which specified states of a stochastic process (Y sub k) can be split each into a countable number of Markovian states. These specified states may occur only at a finite number of times. A corollary gives a condition under which the specified states can occur at any times. Another corollary states that if (Y sub k) is stationary, the process resulting from the splitting can be stationary. Author (TAB)

N69-21565# Wisconsin Univ., Madison. Mathematics Research Center.
A NOTE ON THE STABILITY OF PREDICTOR-CORRECTOR TECHNIQUES Technical Summary Report
James Case Apr. 1968 20 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681482; MRC-TSR-865) Avail: CFSTI CSCL 12/1

The theory of schlicht mappings is used to estimate step sizes which guarantee the stability of a linear multistep method for the integration of ordinary differential equations. Author (TAB)

N69-21574# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
THE GENERALIZED DIRECHLET'S MULTIPLE INTEGRAL
B. D. Sivazlian May 1968 11 p refs
(Contract DAHC04-68-C-0002)
(AD-681996; THEMIS-UF-TR-6; AROD-T-1:19-RT) Avail: CFSTI CSCL 12/1

Liouvilles Extension of Dirichlets Theorem is generalized. It is shown that it is possible to express as a simple integral a large class of multiple integrals of which the Dirichlets Integral is a special case. Author (TAB)

N69-21614# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLACE OF MATHEMATICS IN THE SYSTEM OF SCIENCES
I. A. Akchurin 11 Jul. 1968 24 p refs Transl. into ENGLISH from Vopr. Filosofii (USSR), vol. 21, 1967 p 70–90
(AD-681813; FTD-HT-23-181-68) Avail: CFSTI CSCL 12/1

The article approaches mathematics from the philosophical viewpoint, dwelling on the nonnumerical side of this science. There is penetration, he finds, of mathematical methods into the sphere of social investigations, and the traditional exact sciences must be presented with powerful mathematical equipment. Three stages of mathematical knowledge are found. The first is the simple numerical processing of empirical data. It is also being extended. The stages are not taken up in order but are discussed simultaneously in great detail. The role of topology in mathematics is stressed and discussed in detail. The author states that the tendency to a primary development in our day of the nonmetrical, nonquantitative sections of mathematics proves to be only one side of the more general and profound tendencies characteristics for contemporary natural science as a whole. TAB

N69-21616# University Coll., London (England). Dept. of Psychology.
STOCHASTIC MODELS AND CHOICE BEHAVIOUR Final Report
Robert J. Audley Oct. 1968 68 p refs
(Grant AF-EOAR-69-62)
(AD-681528; AFOSR-69-0171TR) Avail: CFSTI CSCL 5/10

A general stochastic representation of the processes of choice was studied, and several current models were examined as special cases. Alternative models were specified by the pattern of accumulator states that were supposed to lead to an overt response. Three cases were emphasized: (1) a simple accumulator or recruitment scheme, (2) accumulator with inhibition in which excitation coming into one accumulator returns all others to zero, and (3) random walk, a simplified version of the optimal statistical decision device, in which response occurs when the excitation in one accumulator exceeds that in any other by a threshold value. The distribution of decision times, the probability of alternative responses, and indices of vacillation and confidence are derived as formulas in terms of model parameters for models operating in discrete and continuous time. A method was developed for obtaining these properties for any model capable of being expressed as a finite Markov chain. Attention was given to properties that take distinctly different predicted forms for different models. The most important of these is the relation between the latency and relative frequency of a response. Author (TAB)

N69-21624# Wisconsin Univ., Madison. Mathematics Research Center.
IDENTIFYING PERTURBATIONS WHICH PRESERVE ASYMPTOTIC STABILITY Technical Summary Report
Aaron Strauss and James A. Yorke Sep. 1968 13 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681484; MRC-TSR-943) Avail: CFSTI CSCL 12/1

Let the zero solution be uniform-asymptotically stable for $x' = f(t,x)$. Estimates are established in terms of the rate of approach to zero of the solutions of $x' = f(t,x)$, on the magnitude of $g(t,x)$ in order that the zero solution be uniform-asymptotically stable for $x' = f(t,x) + g(t,x)$. A new proof and slight extension of Hahns theorem is given, using these estimates. If f is homogeneous of degree k, then uniform-asymptotic stability is preserved by $g(t,x) = o(/x/^{k})$. Author (TAB)

N69-21626# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
A COMPARISON OF MINIMUM LOGIT CHI SQUARE ESTIMATION AND MAXIMUM LIKELIHOOD ESTIMATION IN RXCX2 CONTINGENCY TABLES: TEST FOR INTERACTION
Charles L. Odoroff Oct. 1968 26 p refs
(Contract N00014-67-A-0298)
(AD-682248; TR-22) Avail: CFSTI CSCL 12/1

The exact small sample properties of twelve goodness of fit tests for interaction for 2x2x2 and 2x2x3 contingency tables are evaluated by enumeration and Monte Carlo sampling. Several modifications of the minimum logit chi square test, the Pearson chi square test, and the likelihood ratio test using an iterative maximum likelihood estimation procedure and three variants of a non-iterative minimum logit chi square estimation procedure are considered. Three criteria are used to evaluate the properties of the tests: (1) the adequacy of the tabular chi square distribution as an approximation to the exact level, (2) the power of the tests, and (3) ease of computation. The minimum logit chi square test (chi sub 13 superscript 2) based upon the non-iterative minimum logit chi square estimation procedure performs the best with respect to the three criteria. Author (TAB)

N69-21652# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Systems Research Section.
APPLICATION OF A DIRICHLET-TYPE SOLUTION TO THE CASE OF DISCRETE BOUNDARY VALUES
T. C. Fang and P. H. Savet Mar. 1969 25 p refs
(RM-440) Avail: CFSTI

Upon an equipotential surface a set of curvilinear coordinates is defined. In terms of these coordinates, a relationship is established between the principal curvature and measurable magnitudes, which are essentially the total curvature and the differential curvature of the equipotential. A set of successive measurements along finite intervals on a trajectory described by a vehicle provides data relative to the principal curvatures. These data are used to determine the nature of the equipotential within a band surrounding the points of measurement. To perform this task an analytical approach is offered that is also usable in actual computation. Author

N69-21668*# Michigan Univ., Ann Arbor
RECURRENCE FORMULAE FOR THE HANSEN'S DEVELOPMENTS
N. X. Vinh [1968] 16 p refs
(Contract NASr-54(06))
(NASA-CR-100533) Avail: CFSTI CSCL 12A

In this paper we derive some recurrence formulae which can be used to calculate the Fourier expansions of the functions $(r/a)^n \cos mv$ and $(r/a)^n \sin mv$ in terms of the eccentric anomaly E or the mean anomaly M. We also establish a recurrence process for computing the series expansions for all n and m when the expansions of two basic series are known. These basic series were given in explicit form in the classical literature. The recurrence formulae are linear in the functions involved and thus make very simple the computation of the series. Author

N69-21698# Stanford Univ., Calif. Dept. of Statistics.
GENERALIZED PROGRAMMING SOLUTION OF CONTINUOUS-TIME LINEAR-SYSTEM OPTIMAL CONTROL PROBLEMS
G. Stephen Jizmagian 24 Jan. 1969 141 p refs
(Contracts Nonr-225(53); Nonr-225(83))
(AD-681761; TR-116; TR-6302-9) Avail: CFSTI CSCL 12/1

An algorithm for solving Dantzigs generalized programming formulation of continuous-time linear-system optimal control problems is developed. Dantzigs work is extended to include continuous-time versions of quadratic loss criteria and minimum fuel problems. New results in parametric linear and quadratic programming problems, where the parameter dependence is nonlinear, are derived with internal schemes to avoid cycling due to degeneracy. Finite switching results in the completely linear system, including the minimum fuel and minimal time problems, are presented without assuming Pontryagins general position principal or uniqueness properties. The procedure initially finds a feasible and admissible solution to the continuous-time problem without using discrete approximations. The algorithm continues to converge monotonically to the optimal solution while remaining feasible and, at each stage, provides a bound on the value of the loss function for termination purposes. This procedure is well suited for systems with a relatively high number of state variables and control inputs for which discrete time linear or quadratic programming models become too large. Author (TAB)

N69-21758# Wisconsin Univ., Madison. Mathematics Research Center.
ON LINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS WITH A REGULAR SINGULAR POINT Technical Summary Report
W. A. Harris, Jr. Aug. 1968 11 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681480; MRC-TSR-931) Avail: CFSTI CSCL 12/1

The note is concerned with the linear system of differential equations $dw/dz = A(z)\,w$ where $A(z)$ is meromorphic at $z = 0$. Necessary conditions for $z = 0$ to be a regular singular point are obtained in terms of order conditions for the symmetric functions of the matrix A. The order conditions are shown to be sharp by example and characterized for an important subclass of matrices. Author (TAB)

N69-21765# Wisconsin Univ., Madison. Mathematics Research Center.
CONVEXITY, PSEUDO-CONVEXITY AND QUASI-CONVEXITY OF COMPOSITE FUNCTIONS Technical Summary Report
O. L. Mangasarian Jul. 1968 17 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681477; MRC-TSR-910) Avail: CFSTI CSCL 12/2

A number of recent results which establish the convexity, pseudo-convexity or quasi-convexity of certain functions are shown to be special cases of the fact that under suitable conditions a composite function is convex, pseudo-convex or quasi-convex. Author (TAB)

N69-21775# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE EXISTENCE OF OPTIMAL RANDOM CONTROLS Technical Summary Report
H. Becker and V. Mandrekar Jun. 1968 27 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681481; MRC-TSR-895) Avail: CFSTI CSCL 12/1

The existence of optimal control for a stochastic control problem is proven. The control problem studied is an open-loop problem and the system is governed by a stochastic integral equation with memory. A class of random generalized controls is introduced and it is shown that in this class there is a control which minimizes the expectation of a semi-continuous functional. Author (TAB)

N69-21776# Wisconsin Univ., Madison. Mathematics Research Center.
APPROXIMATION ON NONHOMOGENEOUS NEUMANN PROBLEMS. REGULARITY OF THE CONVERGENCE AND ESTIMATES OF ERRORS IN TERMS OF n-WIDTH Technical Summary Report
Jean Pierre Aubin Aug. 1968 47 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681479; MRC-TSR-924) Avail: CFSTI CSCL 12/1

A process of approximation of a linear problem is constructed such that, under suitable assumptions, the convergence holds in the space where the solution actually lies. Under the same type of assumptions, the error behaves like the n-width. These results are applied to the approximation of solutions of Neumann variational boundary value problems with irregular data on the boundary. Author (TAB)

N69-21777# Wisconsin Univ., Madison. Mathematics Research Center.
GUARANTEED ERROR BOUNDS FOR COMPUTED SOLUTIONS OF NONLINEAR TWO-POINT BOUNDARY VALUE PROBLEMS Technical Summary Report
Thomas D. Talbot Jun. 1968 174 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681476; MRC-TSR-875) Avail: CFSTI CSCL 12/1

A technique using Newtons Method with interval analysis is developed for computing global error bounds for computed solutions of nonlinear two-point boundary value problems. Author (TAB)

N69-21781# Uppsala Univ. (Sweden). Seismological Inst.
REGRESSION ANALYSIS OF STATISTICAL DATA WITH DIGITAL COMPUTER PROGRAMS, CHAPTER 6
Enders A. Robinson Oct. 1968 51 p refs
(Contract AF 61(052)-702)
(AD-681466; SR-71; AFCRL-69-0010) Avail: CFSTI CSCL 12/1

Chapter 6 deals with Multiple Regression. The theory is given and also computer programs for the solution of problems. Author (TAB)

N69-21800# Michigan Univ., Ann Arbor. Dept. of Mathematics.
CONTINUOUS TRANSFORMATIONS AND INTEGRAL MANIFOLDS Final Report, 1 Sep. 1965–31 Oct. 1968

Lamberto Cesari 6 Jan. 1969 10 p refs
(Grant AF-AFOSR-942-65)
(AD-681829; AFOSR-69-0016TR; Rept-07576-2-F) Avail: CFSTI CSCL 12/1

During the reporting the principal investigator and some of his collaborators completed seventeen research papers. This work is described. The major effort was devoted to problems of optimal control. Existence theorems were proved for lumped parameter control systems by a new type of analysis. A number of related conditions were analyzed with examples and applications. Existence theorems were proved for distributed parameter control systems by the use of Sobolev spaces technique and for partial differential equations written in the rather general form proposed by Dieudonne and Rashevski. A form of Pontryagins principle were proved for these systems which is remarkably similar to a K. A. Lurie problem of magnetohydrodynamic channel flow. Further work concerns: measure theory, integration over a surface area, periodic solutions of nonlinear hyperbolic partial differential equations, in particular, nonlinear wave equations. Author (TAB)

N69-21824# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
STABLE DIFFERENCE SCHEMES WITH UNEVEN MESH SPACINGS
Melvyn Ciment Jun. 1968 66 p refs
(Contract AT(30-1)-1480)
(PB-180836; NYO-1480-100) Avail: CFSTI CSCL 12A

The report describes a finite difference approximation to the Cauchy problem for a first-order hyperbolic partial differential equation using different mesh spacings in different portions of the domain. By reformulating our problem as a difference approximation to an initial-boundary value problem, one is able to use the theory of H. O. Kreiss and S. Osher to analyze the L sub 2 stability of our scheme. Numerical experiments were performed on the CDC-6600. The numerical results indicate that the techniques are an efficient method for improving accuracy in regions of special interest, while preventing new inaccuracies at the interface. Author (USGRDR)

N69-21825# Wisconsin Univ., Madison Dept. of Statistics.
AN IMPROVED FORMULA FOR THE ASYMPTOTIC VARIANCE OF SPECTRUM ESTIMATES
Henry R. Neave (Nottingham Univ., England) Mar. 1968 16 p refs Sponsored in part by NSF
(PB-180840; TR-148) Avail: CFSTI CSCL 12A

When proving results on the asymptotic behavior of estimates of the spectrum of a stationary time-series, it is invariably assumed that as the sample size T tends to infinity, so does the truncation point M sub t, but at a slower rate, so that ((M sub t)/T tends to zero. This is a convenient assumption mathematically in that in particular it ensures consistency of the estimates, but is unrealistic when such results are used as approximations to the finite case where the value of (M sub t)/T cannot be zero. A formula is derived for the asymptotic variance on the assumption that (M sub t)/T tends to a constant gamma; a more accurate approximation to the variance in the finite case is then obtained by using this formula with gamma equal to the actual value of (M sub t)/T. Numerical comparisons are made in the white noise case. Author (USGRDR)

N69-21885# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
APPROXIMATE CONFIDENCE LIMITS FOR COMPLEX SYSTEMS WITH EXPONENTIAL TIME UNTIL FAILURE OF THE COMPONENTS
J. M. Myhre (Claremont Men's Coll., Calif.) and Sam C. Saunders Oct. 1968 30 p refs /tx Math. Note No. 577
(AD-682117; D1-82-0770) Avail: CFSTI CSCL 14/4

The asymptotic distribution of the log-likelihood ratio is shown to provide a method of determining approximate confidence limits for any coherent system when each component has an exponential life with unknown failure rate and component performance data are provided in the form, number of failures (minimum of one) and total operating time. Some computational methods to facilitate the determination of the lower confidence bound at a given level are provided in the important case of a series system. A numerical comparison is made between the nominal confidence level and the actual confidence level, by counting the number of times the true reliability is caught within the confidence bound determined by the likelihood ratio method using repeated computations from random numbers generated with a specified distribution. Author (TAB)

N69-21878# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
COMPUTATION IN DISCRETE STOCHASTIC PROGRAMS WITH RECOURSE
David Rutenberg and Stanley J. Gartska Jan. 1969 27 p refs
(Contract Nonr-760(24))
(AD-681723; WP-22-68-9; RR-151) Avail: CFSTI CSCL 12/2

A solution procedure is presented for discrete stochastic programs with recourse (linear programs under uncertainty). The m stochastic elements of the requirements vector are viewed as an m dimensional space, in which each combination of the discrete values is a lattice point. For a given second-stage basis certain of the lattice points are feasible. A procedure is presented to fit the tightest m dimensional closed interval about these feasible points. Then, infeasible points within this interval are deleted. Thus the aggregate probability associated with lattice points feasible for this basis can be enumerated, and used to weigh the vector of dual variables defined by the basis. A systematic procedure to change optimal bases is presented so that a feasible and optimal basis is found for every lattice point. Author (TAB)

N69-21879# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
SOLUTION OF THE ADI MINIMAX PROBLEM
Eugene L. Wachspress 7 Jun. 1968 54 p refs
(Contract W-31-109-eng-52)
(PB-180846; KAPL-3448) Avail: CFSTI CSCL 12A

A minimax problem arises in numerical solution of certain partial differential equations by an alternating-direction-implicit (ADI) scheme. This problem is solved, and a generalization posed here is analyzed. Author (USGRDR)

N69-21920# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
CONSTRUCTION OF SOLUTIONS OF LINEAR DIFFERENTIAL EQUATIONS WITH QUASI-PERIODIC COEFFICIENTS
Yu. A. Mitropolskii and A. M. Samoilenko Sep. 1968 21 p refs Transl. into ENGLISH from Mat. Fiz. (USSR), no. 3, 1967 p 185-198
(Contract NOw-62-0604-c)
(AD-681782; APL-CLB-3-T-563) Avail: CFSTI CSCL 12/1

The authors consider the problem of constructing a general solution of the system dx/dt = Ax + P(omega t)x, the right-hand side of which is smooth and quasi-periodic with respect to t with a frequency basis omega = (omega sub 1, ...omega sub n). When specific conditions are imposed on A, omega, and P(omega t) it is proved that the solution of the above system has the form x = phi(omega t)e to the power ((A sub o)t) x sub o, where phi(omega t) is a quasi-periodic matrix with the same frequency basis omega

= (omega sub 1,...omega sub n) and a rapidly converging process for the construction of the matrices phi (omega t) and A sub o is given. TAB

N69-21921# Wisconsin Univ., Madison. Mathematics Research Center.
LINEAR PERTURBATIONS OF A FAMILY OF LINEAR SYSTEMS Technical Summary Report
Aaron Strauss and James A. Yorke Oct. 1968 6 p
(Contract DA-31-124-ARO(D)-462)
(AD-681485; MRC-TSR-950) Avail: CFSTI CSCL 12/1

In order that x = 0 be asymptotically stable for x = A(t)x + Bx for every exponentially stable system x = A(t)x, it is necessary and sufficient that B = alpha I for some alpha = or < 0. Author (TAB)

N69-21941# Boeing Scientific Research Labs., Seattle Wash. Mathematics Research Lab.
ON EVALUATION OF WARRANTY ASSURANCE WHEN LIFE HAS A WEIBULL DISTRIBUTION
N. R. Mann and S. C. Saunders Oct. 1968 43 p refs Prepared in cooperation with Rocketdyne *Its* Math note 580
(AD-682081; D1-82-0771) Avail: Issuing Activity CSCL 14/4

A two parameter Weibull model with neither parameter known is assumed for failure time. A value is specified for the probability that no failures, in a lot of identically distributed components yet to be manufactured, will occur before the expiration of the warranty period. The warranty period, which must satisfy an assurance criterion at the prescribed probability level regardless of the true parameter values within the distribution, is to be calculated from a small preliminary sample of life lengths. An expression for the warranty period is derived as a function of the ordered observations and is determined only by the lot size, the sample size and the prescribed assurance level. Author (TAB)

N69-21943# RAND Corp., Santa Monica, Calif.
A THEOREM ON CONTRACTION MAPPINGS
Emmett Keeler and A. Meir Jan. 1969 7 p refs Prepared in cooperation with Alberta Univ.
(AD-681577; P-3993) Avail: Issuing Activity CSCL 12/1

In this note (X, rho) will be a complete metric space and f a mapping of X into itself. A well-known theorem of Banach states: If there exists an alpha < 1 such that for all x, y epsilon X rho(f(x), f(y)) = or < alpha . rho (x,y), alpha < 1 then f has a unique fixpoint (i.e., point xi such that f (xi) = xi). It is shown that the conclusion of Banachs Theorem holds more generally from a condition of weakly uniformly strict contraction. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-20970*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS OF INTERPRETATION OF SATELLITE WEATHER DATA [VOPROSY INTERPRETATSII DANNYKH METEOROLOGICHESKIKH SPUTNIKOV]
M. I. Yudin et al Mar. 1969 422 p refs Transl. Tr. Gl. Geofiz. Observ. (Leningrad), no. 166, 1964
(NASA-TT-F-12301) Avail: CFSTI CSCL 04B

A collection of articles is presented on the study of the atmosphere by weather satellites, and interpretation and use of satellite data in meteorology. Reported subjects include: (1) long wave, short wave, and thermal radiation, and (2) numerical interpretation of cloud information. Author

N69-21004# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
CONDITIONAL PROBABILITIES OF PRECIPITATION AMOUNTS IN THE CONTERMINOUS UNITED STATES
Donald L. Jorgensen, William H. Klein, and Charles F. Roberts Mar. 1969 92 p refs
(WB-TM-TDL-18) Avail: CFSTI

Conditional probabilities of precipitation are derived from a 15-year period of record for 108 selected stations within the 48 conterminous states. The required condition is that precipitation occurs within given periods. The probabilities are then computed for seven quantitative ranges in which amounts equal or exceed specified values. The investigation includes four 6-hour and two-12 hour periods, as well as one 24-hour period, with the data stratified by seasons. The resulting probabilities vary with station, season, and time of day. Application of the probabilities to weather forecasting is discussed. Additional precipitation characteristics and suggested applications are presented in the appendices. Author

N69-21015*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
FUTURE PROSPECTS FOR THE USE OF SATELLITE METEOROLOGICAL DATA FOR WEATHER FORECASTING [BLIZHAYSHIYE PERSPEKTIVY ISPOL'ZOVANIYA DANNYKH METEOROLOGICHESKIKH SPUTNIKOV DLYA DOLICHESTVENNOGO PROGNOZA POGODY]
M. I. Yudin Washington NASA Mar. 1969 13 p refs Transl. into ENGLISH from Russian Rept. Paper presented at U.N. Conf. on the Exploration and Peaceful uses of Outer Space, Vienna, 14–27 Aug. 1968
(Contract NASw-1692)
(NASA-TT-F-12174) Avail: CFSTI CSCL 04B

The advantages and disadvantages of assuming that atmospheric processes are adiabatic are discussed in relation to the problems of predicting weather on the basis of satellite and ground measurements. Various types of information from satellite meteorological data are classified in terms of their significance and the probability of error or the possibilities of obtaining accurate and timely data. It is concluded that quantitative weather forecasting based on satellite data will be found very useful in the future. Author

N69-21110*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
THE USE OF A GROUND-BASED MULTIPLE-BEAM DETECTOR IN CROSSED-BEAM ATMOSPHERIC EXPERIMENTATION
W. H. Heybey 30 Jan. 1969 30 p
(NASA-TM-X-53813) Avail: CFSTI CSCL 04B

Experimentation is planned at MSFC test sites to measure near-ground winds both by tower-mounted anemometers and by a crossed-beam system combining a single-beam with a multiple-beam detector. The pertaining beam geometry is studied in the present report, its range of physical applicability is examined, and a proposal is made of what is considered a best detector arrangement for observing horizontal winds at different heights simultaneously. Author

N69-21122*# Aztec School of Languages, Inc., Acton, Mass.
TROPICAL ZONE WEATHER IN INFRARED RAYS [POGODA TROPICHESKOY ZONY V INFRAKRASNYKH LUCHAKH]
P. N. Belov Washington NASA Mar. 1969 15 p refs Transl. into ENGLISH from Russian conf. paper Presented at the UN Conf. on the Exploration and Peaceful uses of Outer Space, Vienna, 14–27 Aug. 1968
(Contract NASw-1692)
(NASA-TT-F-12175) Avail: CFSTI CSCL 04B

The authors discuss satellite measurements in the infrared spectra of tropical zones and relate these data to the cloud fields of tropical cyclones and intertropical convergence zones. It is shown that these observations are very useful in studying the migration of weather zones, particularly intertropical convergence zones. Author

N69-21135# Environmental Science Services Administration, Silver Spring, Md. Environmental Data Service.
MINIMUM TEMPERATURE PATTERNS OVER NEW YORK STATE ON TWO WINTER NIGHTS
A. Boyd Pack Feb. 1969 17 p
(EDSTM-7) Avail: Issuing Activity

Changes in the minimum temperature as observed at numerous cooperative and first-order weather stations in New York State on two winter nights are described. The two nights were January 16, and January 17, 1965. Minimum temperatures were from 10 to 14 degrees F colder on the 17th than on the 15th in southwestern New York State and in the eastern Finger Lakes. Minima were warmer by a similar margin on the 17th in the eastern Adirondacks and Lake Champlain area. Interesting contrasts in the change of minimum temperatures between the two dates occurred among reporting stations in the western half of the State. Author

N69-21148*# Stanford Research Inst., Menlo Park, Calif.
STUDIES OF VERTICAL WIND PROFILES AT CAPE KENNEDY, FLORIDA Final Report
R. M. Endlich, R. C. Singleton, K. A. Drexhage, and R. L. Mancuso Feb. 1969 94 p refs
(Contract NASS-21148)
(NASA-CR-61263) Avail: CFSTI CSCL 04B

The structure, persistence, and predictability of details of vertical wind profiles are studied, based on sequences of wind profiles measured at Cape Kennedy, Florida, using the FPS-16 radar/Jimsphere technique. The details of the flow are shown by wind measurements at 25 m intervals between the surface and the lower stratosphere. The main analytical tool used is spectrum analysis, using the fast Fourier transform for computation. Spectra were computed for deviations from mean speed profiles, and for speed changes between successive wind profiles. Numerical methods of forecasting the general wind profile for periods twelve to twenty-four hours in advance are described. These methods are based on objective analyses of standard wind observations. The forecast is made by advection of fields of wind components, vorticity, and divergence, with winds matched to the forecast vorticity by a direct method. Author

N69-21170# Imperial Coll. of Science and Technology, London (England).
RESEARCH ON CLOUD FORMATIONS Final Report
A. B. Fraser and R. S. Scorer Jun. 1968 50 p refs
(Contract Cwb-11284)
(PB-182074) Avail: CFSTI CSCL 04B

Convection in the atmosphere is significantly different from cellular convection in viscous fluids because the Rayleigh number is many orders of magnitude greater and because the air between cumulus clouds is stably stratified and can therefore produce a local warming through subsidence and without mixing. The report defines a region called 'the white box' in which the vertical motion induced directly by buoyancy forces is confined. It is in hydrostatic equilibrium with its environment so that there is no transfer of sensible heat across its boundary. The interaction of the cumulus and the environment is thus reduced to a horizontal mass flux. Author (USGRDR)

N69-21269# Joint Publications Research Service, Washington, D. C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 199 28 Feb. 1969 p 8–69 refs (See N69-21267 10-13)
Avail: CFSTI

Brief news items are presented, including reports on ice floe pattern detection, a study on air pollution, a cloud physics symposium, meteorological instruments and measurement errors, and meteorological research facilities. Sixty-five abstracts of recent Soviet articles are supplied, along with complete bibliographic information. Clear sky echo radar characteristics, cumulus clouds and cloud cover data jet stream studies, methods for forecasting pressure fields and thunderstorms, and precipitation research are some of the areas covered. P.A.B.

N69-21305# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
NINTH METEOROLOGICAL YEARBOOK [9 ANNUARIO METEOROLOGICO]
G. Bollini and C. Gandino 1969 94 p refs In ITALIAN; ENGLISH summary
(EUR-4099.i) Avail: CFSTI

After a short description of the methods for measuring and elaborating atmospheric phenomena, tables and graphs for the meteorological year 1967 are reported. With the observatory's data, temperature measurements at station no. 4, 43 m lower, and the flow of the Novellino brook are added. Author

N69-21319# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, Dec. 1968
1968 16 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data observed at Uccle (Belgium) in December 1968 are given. ESRO

N69-21357# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA, 1967 [ILMASTOHAVAINNOT, 1967]
1968 90 p In ENGLISH and FINNISH *Its* Vol. 67, Pt. 1a- 1967
(Rept-551.506.1(480)) Avail: CFSTI

The tables in this yearbook were drawn up according to the principles laid down by the International Meteorological Organization in Warsaw (1935) and Salzburg (1937). This yearbook was compiled with the aid of electronic computers, and this work was done on IBM System 360. Daily observations were recorded at Jokioinen on air temperature, maximum and minimum temperatures, precipitation, depth of snow, air pressures, relative humidity, wind direction and speed, state of ground surfaces, amount of clouds, and weather phenomena. J.A.M.

N69-21552# Fleet Operations Control Center, Pacific Fleet, San Francisco, Calif.
DATAPACK
Oct. 1968 63 p refs
(AD-682218; FOCCPAC-TR-43) Avail: CFSTI CSCL 4/2

The DATAPACK Program creates a systematic and standardized data base of historical weather observations on magnetic tape.

Observations received from NWRC, Asheville, North Carolina, and other sources on magnetic tape in a variety of formats are converted and packed on magnetic tape in a standard format.
Author (TAB)

N69-21572# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALL-UNION SCIENTIFIC METEOROLOGICAL CONFERENCE TRANSACTIONS (SELECTED ARTICLES)
D. A. Dorgatsev et al Apr. 1968 44 p refs Transl. into ENGLISH from Tr. Usesoyuznoe Nauchn. Meteorol. Soveshch. (USSR), v. 3, 1963 p 72–76; 156–171
(AD-682064; FTD-MT-24-301-67) Avail: CFSTI CSCL 4/2

Contents: Concerning the influence of mountain massifs on atmospheric circulation; Connection of fluctuating conditions of solar activity and total circulation of terrestrial atmosphere; Concerning the influence cycles of solar activity of various duration on certain characteristics of atmospheric processes. TAB

N69-21578# Metronics Associates, Inc., Palo Alto, Calif.
FP TRACER CO-DISPERSAL AND SAMPLING STUDIES Technical Report, Jul. 1965–Jul. 1967
James A. Murray, Theron S. Brown, and Frank X. Webster Dec. 1968 170 p refs
(Contract DA-42-007-AMC-240(R))
(AD-682012; DPG-TR-135) Avail: CFSTI CSCL 15/2

The study was undertaken to investigate the effect of co-dispersal of FP with other materials and tracers and to improve the representation of the efficiencies of the co-dispersal dissemination systems and the air sampling systems. The co-dispersal studies of FP 2267-Yellow and FP 3206-Green with other fluorescent tracers of various sizes, densities and colors and with BG were performed using the high speed centrifugal blower as a dissemination device. FP aerosol clouds comprised of up to four different fluorescent colors were generated, sampled and assessed. The reproducibility and limitations of co-dispersal results, the blower co-dispersal efficiency and new co-dispersal applications are described. The sampling performance of the membrane filter sampler was investigated. A collection efficiency of the Rotorod sampler was measured using standard procedures. Also, the collection efficiency was determined using modified collector shapes and coating procedures which were developed to enhance the assessability of the Rotorod FP collections. Sampling studies were conducted with the 6-second and 30-second Drum Pulsed Sequential FP sampler. TAB

N69-21702# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
AN ADVANCED METEOROLOGICAL SOUNDING SYSTEM Final Report, 1 Jul. 1964–15 Apr. 1968
Kenneth J. Wood, Warren M. Griggs, and Elvin F. Krasin Bedford, Mass. AFCRL Apr. 1968 220 p refs
(Contract AF 19(628)-4215)
(AD-681470; AFCRL-68-0540; WS-3022-1) Avail: CFSTI CSCL 4/1

The report summarizes and analyzes work performed during a 3-1/2 year period on development of an advanced meteorological sounding system. This report includes a description of such a system, a discussion of the performance requirements for the subsystem components, and an analysis of the slant range, altitude and telemetry errors inherent in the proposed system. The developed system provides continuous and automatic reception, extraction, reduction and recording of slant range, telemetry, time and antenna coordinates. Unambiguous slant range is determined by means of a 31 bit PN code with a range readout resolution of approximately 5 feet. Telemetry is accommodated by two channels, one continuous and the other time division multiplexed in which the modulation form in PAM/FM/PM on the downlink. Telemetry readout resolution is better than 0.1%. The system is designed to provide operation at slant ranges up to 300 kilometers with only 35 milliwatts of radiosonde transmitter power. This report also provides measured data on the mechanized ground system which included a 30 watt solid state transmitter, auto-track receiver, range extractor, telemetry extractor data processor, tape punch and associated displays.
Author (TAB)

N69-21750# Air Force Cambridge Research Labs., Bedford, Mass.
VERTICAL PROFILES OF WIND SPEEDS FROM MEASUREMENTS ON HIGH TOWERS
M. M. Borisenko et al Dec. 1968 21 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 210, 1967 Prepared by Transtek Assoc., Reading, Mass.
(AD-681659; AFCRL-68-0653; TRANS-38) Avail: CFSTI CSCL 4/2

The paper considers profiles of wind velocities in the boundary layer computed from measurements of high towers in West Germany, England, Australia, the United States (Cedar Hill, Texas), Japan, and the USSR.
Author (TAB)

N69-21834# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSFER OF HEAT AND MOISTURE AND FORMATION OF TEMPERATURE AND PRECIPITATION FIELDS ON THE EUROPEAN TERRITORY OF THE USSR
V. G. Semenov Jul. 1968 38 p refs Transl. into ENGLISH from Tr. Tsentral. Inst. Prognozov (Moscow), no. 154, 1966 p 68–93
(AD-682111; FTD-MT-24-131-68) Avail: CFSTI CSCL 4/1

An examination was made of the relationship between horizontal heat and moisture transport to Europe and the water temperature in the northern part of the Atlantic Ocean; the correlation between the advective and turbulent components of horizontal moisture transport are evaluated; a relationship is found between flows of heat and moisture over the European territory of the USSR and temperature and precipitation fields over this territory.
Author (TAB)

N69-21851# Tactical Air Reconnaissance Center (TAC), Shaw AFB, S. C.
RECONNAISSANCE WEATHER PLANNING FACTORS FOR FAIR WEATHER SYSTEMS (GERMANY)
Roy T. Wiggins 6 Dec. 1968 156 p *Its* Operations Analysis Working Paper No. 68-3
(AD-681463) Avail: CFSTI CSCL 4/2

No existing high resolution reconnaissance sensor can penetrate clouds. This study was directed toward providing weather synopses that will be useful to users, planners, and designers of reconnaissance systems. It contains information on the percentage of time a ceiling exists at or above specific altitudes for specific time periods. This information is plotted by month and then by time of day on a year-long basis. This report is on Germany, and for this study Germany was divided into seven areas (actually eight if one includes the excluded terrain for which there are no representative weather data). Included are data on an around-the-clock basis for all seven areas.
Author (TAB)

N69-21853# San Jose State Coll., Calif. Dept. of Meteorology.
AVIATION TERMINAL WEATHER FORECAST STUDY Final Report
Robert C. Lile Jul. 1968 103 p refs
(Contract Cwb-11379)
(PB-180695) Avail: CFSTI CSCL 04B

The report describes the work being done at San Jose State College to develop an improved numerical system for the prediction of aviation weather at Pacific Coast air terminals. These Boolean predictor models were to be tested by the sponsoring organization in a statistical regression analysis (Regression Estimation of Event Probabilities—REEP) with previously selected variables in order to evaluate the effectiveness of the Boolean device. Author (USGRDR)

N69-21886# New York Univ., N. Y. Dept. of Meteorology and Oceanography.
DESIGN STUDY FOR A WEATHER MODIFICATION EXPERIMENT IN THE NORTHEASTERN UNITED STATES Final Report
Jerome Spar Aug. 1968 92 p refs
(Grant ESSA-E22-112-67(G))
(PB-180295; GSL-TR-68-11) Avail: CFSTI CSCL 04B

The establishment of a randomized-operational type ground-level silver iodide seeding experiment for year-round precipitation augmentation in central New York State is recommended. An experimental design is proposed in which the basic unit in a 24-hour 'seedable day', and seeding is restricted to two weather types. A method for estimating expected target area precipitation by pattern fitting and extrapolation from upwind control area data is described, and a procedure is outlined for the use of these estimates in evaluation of the experiment. Author (USGRDR)

N69-21892# Weather Bureau, Silver Spring, Md. Data Acquisition Div.
THE COMPATIBILITY OF RADIOSONDE DATA AT STRATOSPHERIC LEVELS OVER THE NORTHERN HEMISPHERE
Raymond M. McInturff and Frederick G. Finger Dec. 1968 64 p refs
(WBTM-DATAC-2) Avail: Issuing Activity

Day–night differences in temperature and height are used as the basis for a system designed to achieve compatibility between data measured by the various radiosonde instruments employed throughout the Northern Hemisphere. The resultant compatibility adjustments in reported data are a prerequisite to the analysis of stratospheric constant-pressure charts above the 100-mb level. Details of the adjustment system are given. It is found that at 10 mb adjustments of as much as 14°C and 574 meters are needed to attain day–night compatibility. Adjustments are frequently necessary even when corrections are applied to the data prior to transmission. These values are in most cases to be subtracted from daytime reports, and they are functions of solar elevation angle. It is stressed that application of the results presented should be restricted to problems of compatibility, as in synoptic analysis, since, in the absence of an absolute standard, it is impossible to characterize any one radiosonde report as more nearly correct than another. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-20720 Service Technique de l'Aeronautique (Belgium).
STUDY OF AUTO-SYSTEMS ADAPTABLE TO MIRAGE 3 [ESSAIS DE SYSTEMES AUTO-ADAPTABLES SUR MIRAGE 3]
J. C. Peard Sep. 1968 23 p refs In FRENCH Presented at AGARD Symp. on Advanced Flight Control Concepts, Oslo, 3-5 Sep. 1968
(C-153-1) Avail: CFSTI

The principles of operation of oscillation dampers were studied on the Mirage 3 aircraft. Results for flight tests performed on active system type 140 and on passive system type 166 are described and compared. The gain of the active system is regulated as a function of guidance efficiency which is detected by the amplitude of the aircraft response to a test signal of fixed frequency applied to the guidance level. The operational principles of Type 166 use paralinear laws which permit gain reduction with frequency without losing phase. The capacities of self-adaptation of a nonlinear passive system are reduced, but such a system seems to have greater security and simplicity possibilities than an active system. It appears probable that the nonlinear passive system presents a solution preferable to a linear or an active system. Transl. by P.A.B.

N69-20803# Royal Aircraft Establishment, Farnborough (England).
STUDIES OF THE DESIGN OF A TRANSATLANTIC ROUTE STRUCTURE FOR SUPERSONIC TRANSPORTS
V. W. Attwool Jul. 1968 39 p refs
(RAE-TR-68183) Copyright. Avail: CFSTI

This report presents the results of fast-time simulation studies of possible systems for Concorde and other SST traffic over the North Atlantic. For a given layout of the track system and level of traffic flow, the simulations give the incidence of deviations and delays, from which we estimate the required increase in fuel reserve and extra cost penalty. Results show the advantage of a single-layer track system with aircraft free to cruise-climb, the large effect of possible restrictions to avoid sonic-bang overland, the effect of variations in separation minima, and the advantage of an ATC system using entry delay on a tactical basis to facilitate maximum use of the best tracks in the system. Author (ESRO)

N69-20938*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FIXED-BASE VISUAL SIMULATION OF PILOT CONTROLLED DESCENTS OF AN ADVANCED APOLLO SPACECRAFT WITH AN ALL-FLEXIBLE PARAWING
G. Kimball Miller, Jr., Byron M. Jaquet, and Douglas B. Price Washington Mar. 1969 61 p refs
(NASA-TN-D-5049) Avail: CFSTI CSCL 17G

A fixed-base visual simulation study has been conducted to determine the ability of an onboard pilot to control an all-flexible parawing and an advanced Apollo capsule combination to preselected landing sites. The investigation employed a closed-circuit television system in conjunction with an earth-terrain model for image generation and permitted six rigid-body degrees of freedom of the vehicle. The pilot controlled the vehicle through the use of a hand controller which activated simulated constant-rate reels to induce rear keel-line changes for pitch control and differential wing-tip line changes for lateral control. The simulated viewing system provided the pilot with a field of view of 34.6° by 48.3°. The optical axis of the viewing system could be controlled in pitch to permit viewing anywhere between the local vertical and the local horizontal. The pilot's task was to assume command of the vehicle at altitudes up to 18000 feet (5486.4 meters) and control the vehicle to the center of a specified landing site under the influence of various wind profiles with maximum velocities up to 27 ft/sec (8.2 m/sec). The results of the investigation showed that the pilots could consistently land within about 1400 feet (426.7 meters) of the center of the desired site regardless of the wind conditions or instrumentation employed. Author

N69-21003# Federal Aviation Agency, Atlantic City, N. J. National Aviation Facilities Experimental Center.

ATCBI-3 ALTITUDE AND IDENTITY READOUT MODIFICATIONS Final Report

George H. Mahnken Mar. 1969 100 p refs

(NA-69-28; RD-69-5) Avail: CFSTI

This report deals with technical aspects of the design, development implementation and performance of a low-cost equipment modification providing 4096 radar beacon identity code decoding and altitude readout capabilities. It was designed for installation and operational test. The modification and addition to expand the capabilities of the Air Traffic Control Radar Beacon System (ATCBI-3) to provide 4096 beacon identity code decoding and altitude readout is described. The technical test results indicated that the equipment performed as technically designed, and consistently presented correct identity and altitude readouts. Author

N69-21093*# Boeing Co., Renton, Wash. Commercial Airplane Div.

EXPERIMENTAL L-BAND SST SATELLITE COMMUNICATIONS/SURVEILLANCE TERMINAL STUDY. VOLUME 1: STUDY SUMMARY

Thomas K. Foley and Robert W. Sutton Nov. 1968 98 p refs

(Contract NAS12-621)

(NASA-CR-86129; D6-60105-Vol-1) Avail: CFSTI CSCL 17G

A program definition study was carried out on the design of an experimental L-band supersonic sonic transport communications/surveillance terminal. The terminal, in conjunction with a satellite system, would demonstrate the capability of extending air traffic control (ATC) surveillance and communications functions over the North Atlantic area on a full-time basis. The study includes development of the operational requirements imposed on both satellite and aircraft terminals. Aircraft traffic forecasts for 1975 through 1980 are developed and the peak loading estimates are used as a basis for deriving specific surveillance and communications requirements. It is concluded that a system designed to meet the derived requirements (1-n.mi. surveillance accuracy) would allow reduction of the current 120-n.mi. lane-separation standards to a goal of 30 n.mi. for an SST equipped with an inertial navigation system (INS). In addition, six voice channels are shown to be adequate for ATC/aircraft message requirements under such loading conditions. The study highlights are summarized for the various analysis tasks conducted in developing the performance requirements and the specific terminal baseline design. Author

N69-21094*# Boeing Co., Renton, Wash. Commercial Airplane Div.

EXPERIMENTAL L-BAND; SST SATELLITE COMMUNICATIONS/SURVEILLANCE TERMINAL STUDY. VOLUME 2: OPERATIONAL REQUIREMENTS STUDY

James T. Burghart Nov. 1968 154 p refs

(Contract NAS12-621)

(NASA-CR-86130; D6-60105-1-Vol-2) Avail: CFSTI CSCL 17G

The development of the operational requirements is presented for an L-band satellite system performing air traffic control (ATC) in the North Atlantic airlines. The current oceanic ATC procedures and traffic are considered and the increased benefits are given for extended ATC capabilities to a satellite system for handling the expected airplane and passenger traffic growth through 1980. The requirements for the ATC satellite system are developed for traffic in the open oceanic area between latitudes 40°N and 60°N and longitudes 10°W and 50°W. Using the traffic forecasts, specific surveillance and communications requirements are developed for use in the aircraft terminal design. The results of the surveillance requirements analysis show the potential reduction in separation standards that can be achieved in terms of required aircraft position accuracies, surveillance fix rate, and onboard navigation capability. The analysis was carried out using results of surveillance and collision-risk mathematical models. It is concluded that a system satisfying the derived requirements (including a 1-n.mi. surveillance accuracy) would permit reduction of the current 120-n.mi. lane-separation standards to a goal of 30 n.mi. for inertial navigation system-equipped supersonic transports and to a goal of 60 n.mi. for present-day subsonic jet aircraft without an INS. Author

N69-21095*# Boeing Co., Renton, Wash. Commercial Airplane Div.

EXPERIMENTAL L-BAND; SST SATELLITE COMMUNICATIONS/SURVEILLANCE TERMINAL STUDY. VOLUME 3: COMMUNICATIONS/SURVEILLANCE ANALYSIS

Thomas K. Foley, Bruce J. Gaumond, and Edward Sestak Nov. 1968 287 p refs

(Contract NAS12-621)

(NASA-CR-86131; D6-60105-2-Vol-3) Avail: CFSTI CSCL 17G

The detailed analysis and tradeoff tasks are presented for both the surveillance and communications functions of an L-band aircraft terminal used with an air traffic control (ATC) satellite system. A multisatellite concept is found preferable over single-satellite concepts to provide an ATC satellite surveillance capability. Both continuous multiple-tone ranging and BINOR ranging modulation techniques are evaluated for the surveillance signal in terms of link performance and impact on the aircraft terminal complexity. It is concluded that either technique provides adequate capability for required North Atlantic surveillance accuracies, although the tone system results in a simpler terminal design. The effect of different satellite link-routing alternates is treated and the requirements for forward and return data links established for an interrogation/response surveillance system. Techniques of both random-and controlled-access voice channel usage for an operational system are also evaluated. The stringent power requirements for the satellite- to-aircraft voice links lead to a consideration of alternate voice modulation techniques that offer improvements in link threshold performance. Author

N69-21096*# Boeing Co., Renton, Wash. Commercial Airplane Div.

EXPERIMENTAL L-BAND; SST SATELLITE COMMUNICATIONS/SURVEILLANCE TERMINAL STUDY. VOLUME 4: AIRCRAFT ANTENNA STUDIES

W. V. Kiskaddon and Duncan M. Carman Nov. 1968 80 p refs

(Contract NAS12-621)

(NASA-CR-86132; D6-60105-3-Vol-4) Avail: CFSTI CSCL 17G

The L-band antenna system considered for the supersonic transport (SST) for satellite communications must satisfy gain requirements imposed by power-limited voice links between the satellite and aircraft and also meet the flush-mounted constraint imposed by the aerodynamics of the SST. The results are presented of an analytic and experimental evaluation carried out to develop antenna requirements for the SST aircraft terminal. Antenna coverage and gain criteria, multipath rejection requirements, and environmental limits of the antenna system are described for an experimental terminal capable of demonstrating surveillance and voice communications in the 1540-to 1660-MHz (L-band) frequency range. Data on low-gain antennas, mechanically steered antennas, phased arrays, and possible antenna locations on the SST are provided. Selection of possible antenna systems is discussed for an airplane experimental terminal capable of operation with satellites. Experimental patterns of a circularly polarized orthogonal-mode-cavity antenna mounted on a cylinder simulating the SST are used as the basis for the low-gain antenna discussion. Author

N69-21097*# Boeing Co., Renton, Wash. Commercial Airplane Div.
EXPERIMENTAL L-BAND; SST SATELLITE COMMUNICATIONS/SURVEILLANCE TERMINAL STUDY. VOLUME 5: AIRCRAFT TERMINAL DEFINITION
Thomas K. Foley and Marvin W. Alnutt Nov. 1968 81 p refs
(Contract NAS12-621)
(NASA-CR-86133; D6-60105-4-Vol-5) Avail: CFSTI CSCL 17G

Specific aircraft terminal designs are developed for both experimental and operational SST terminals for use in an L-band satellite communications/surveillance air traffic control (ATC) system. The designs are based on the requirements and analyses of the previous study documentation volumes. The terminal rf performance levels are defined for three postulated satellite alternate levels, nominally, 24dBW, 35 to 40 dBW, and 50 dBW. The various terminal design tradeoffs are considered for each level, and a preferred experimental terminal design is selected to match the medium-capability, which is consistent with the potential capability of the ATS-F and G satellites. Detailed functional descriptions, including block diagrams, are presented for the selected design. The hardware elements are chosen based on the results of an extensive equipment state-of-the-art survey of transmitter and receiver devices. An operational terminal design is also presented predicated on expected 1975 satellite technology. The design is characterized by both surveillance and multichannel voice operation with a low-gain antenna system and a 50-watt solid-state power amplifier at the aircraft terminal. Author

N69-21402*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
DIRECTION COSINE COMPUTATIONAL ERROR
John W. Jordan Washington Mar. 1969 104 p refs
(NASA-TR-R-304) Avail: CFSTI CSCL 17G

Strapdown inertial systems possess a potential advantage over more conventional inertial systems since they do not require a mechanical gimbal structure to maintain a stable coordinate reference. Instead, strapdown systems replace the gimbal structure by a direction cosine matrix which is contained in and updated by the system computer. To assess the performance of a strapdown system or to determine the computer requirements, a detailed study of the computational error introduced by the computer is necessary. This report is concerned with the techniques which may be employed to estimate the computational error and its effects on system performance. Although focused upon a particular problem of practical importance, many of the techniques have a wider applicability to aerospace software in general. Author

N69-21502*# Bendix Corp., Teterboro, N.J.
DESIGN AND DEVELOPMENT OF A MULTIPURPOSE, BORESIGHTED STAR TRACKER
George V. Zito and E. A. Chilton Washington NASA Mar. 1969 117 p refs
(Contract NAS5-3780)
(NASA-CR-976) Avail: CFSTI CSCL 17G

The multipurpose star tracker contains several novel features: (1) the Channeltron ® image dissector which replaces the plurality of dynodes required by conventional photomultipliers with a single continuous strip electron multiplier; (2) a scanning system in which a multi-lobed scan serves for both acquisition and tracking in a single mode, automatically generating proportional and saturated zones; (3) the use of magneto-resistive bridge multipliers as modulators; and (4) microcircuited timing and demodulator circuits. It will track navigational stars and the center of illumination of the planets Mars, Venus, and Mercury. It will track the brighter of two stars within its 8 degree field of view provided the star is brighter than one visual magnitude and separated from other stars by at least 50 minutes of arc. The completed tracker weighs only 5 lbs and requires 4.65 watts of power. The prototype unit and the flight unit have been supplied with alternate mounting configurations to satisfy a wide range of applications.

N69-21517# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF THE THEORY OF AUTOMATED AIR NAVIGATION
N. G. Rachkovskii May 1968 178 p refs Transl. into ENGLISH of Osnovy Teorii Automatizirovannogo Samoletovazhdeniya (Moscow), 1966 p 1-127
(AD-682063; FTD-MT-24-51-68) Avail: CFSTI CSCL 17/7

This book is intended for engineers working in the design and operation of automated navigational systems; it can also be useful to students in the field of navigation at higher technical education institutions. The main topic of the book is the theory of automatic aerial navigation, its techniques, and methods for solving navigation problems. Navigation systems and their application to high-speed modern aircraft are discussed in theory and practice, and preflight preparations, route plots, location of reference points, and the computation system used are analyzed. TAB

N69-21520# RAND Corp., Santa Monica, Calif.
AIR TRAFFIC CONTROL TRUTH AND CONSEQUENCES
S. L. Katten Nov. 1968 84 p
(AD-681770; P-3964) Avail: CFSTI CSCL 17/7

Contents: The system concept; Historical background; The current air traffic control system; Air transportation system problems; Air traffic control problems; Some probable causes and objectives to alleviate them; Alternative consequences. TAB

N69-21671*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
LAUNCH VEHICLE GUIDANCE SRT PROGRAM TECHNICAL REVIEW NO. 4
[1968] 209 p
(NASA-CR-100538) Avail: CFSTI CSCL 17G

A technical review of the testing and research program for a launch vehicle guidance system is presented. Topics include the development and status of the breadboard strapdown inertial system; inertial components; modular computer; integrated control system; and the redundant sensor inertial system. A.C.R.

N69-21672*# Massachusetts Univ., Amherst. Engineering Research Inst.
DESIGN OF A PITCH ORIENTATIONAL FLIGHT CONTROL SYSTEM
R. A. Bell and R. V. Monopoli Jan. 1969 70 p refs
(GRANT NGR-22-010-012)
(NASA-CR-100528; Rept-2) Avail: CFSTI CSCL 17G

Two designs are presented for a pitch orientational flight control system. Both designs employ control techniques based on Liapunov's direct method which are used in conjunction with system estimation. One design yields a nonlinear control law and the other a linear control law, with a linear estimation technique being used in both cases. The designs are developed using approximate models of the system components, and very satisfactory experimental results are obtained using these approximations. A stability problem arises, however, when the higher order dynamics of the system are considered. This problem is overcome in the linear design by including proper compensation in the controller. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-20721# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
EXAMINATION OF THE INTERNATIONAL ATOMIC ENERGY AGENCY'S REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIALS. VOLUME 1. TECHNICAL PACKAGING REQUIREMENTS. AN ANALYSIS OF THE CRITERIA AND TESTS, TOGETHER WITH A STUDY OF PRACTICAL MEANS OF COMPLIANCE Final Report
1968 277 p refs
(Contracts EURATOM-024-65-6-FCIC)
(EUR-3485-E, F-Vol-1) Avail: CFSTI

The present file consists in a general report on the Regulations as a whole. It is intended to round off the specialist reports making up the following volumes, to summarize them and place them in the general context. The Regulations are analyzed in their present state, including a partly historical explanation of all their basic provisions. A large part is devoted to the activity limits and nuclear safety criteria which express the safety theories on which the Regulations are founded. Comments are presented on the practical implementation of the Regulations, based mainly on the work of those entrusted with studies. A general rundown is provided. In particular, concrete formulas are provided for a solution to the problem of demonstrating theoretically the behaviour of a type B package during thermal testing. As regards the demonstration of satisfactory behaviour during thermal tests, a set of practical laws is defined with an indication of technical solutions and methods of calculation on particular organs. The conclusion is that the Regulations are well-constructed and reasonably and realistically based, and that their practical implementation is entirely feasible.
Author

N69-20795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF TUNGSTEN-184 AS A THERMAL FLUX MONITOR AT HIGH TEMPERATURES
Lauren L. Ball, Paul J. Richardson, and Dean W. Sheibley Washington Mar. 1969 9 p refs
(NASA-TN-D-5113) Avail: CFSTI CSCL 18D

Tungsten-184 has been found to be a useful dosimeter for thermal neutrons, particularly for high-temperature applications. Correlation of neutron flux with cobalt-59 activation and uranium-235 fission density for short-term irradiations is shown. The tungsten-184, thermal neutron capture cross section in the Plum Brook Reactor was found to be 1.94 ± 0.08 barns. Cadmium ratios for tungsten-184 are about one-fifth of the value found for cobalt-59. The radiochemistry and counting techniques for tungsten-185 are described.
Author

N69-20854*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPEX 2: A RADIATION SHIELD OPTIMIZATION CODE
Gerald P. Lahti Washington Mar. 1969 26 p refs
(NASA-TM-X-1769) Avail: CFSTI CSCL 18F

A radiation shield optimization procedure based on the computer code, OPEX-II, is described. The OPEX-II code, based on an earlier, steepest-descent-method code OPEX, has been recoded to improve coding, simplify data input, use spherical geometry, and alter the dose-thickness relation when a layer has been removed. A complete description of how to obtain the necessary input data for OPEX-II from other transport calculations is given. Data input instructions, FORTRAN-IV code listing, and a sample problem optimizing a seven-layer shield of tungsten and lithium hydride for a space power reactor are given.
Author

N69-20945# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
AN EXPERIMENTAL STUDY OF THE MACROSCOPIC SELF-SHIELDING EFFECT IN SAMPLES CONTAINING BURNABLE POISONS
B. Arcipiani 15 Nov. 1968 29 p refs
(RT/FI(68)53) Avail: CFSTI

The self-shielding factor of small samples containing very fine grains of gadolinium oxide or zirconium boride has been inferred from measurements of their effective absorption in the center of the RANA reactor. The procedure followed and the several assumptions made for the treatment of the experimental data are described.
Author

N69-20962# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
THE USE OF THE SORA-REACTOR FOR NEUTRON PHYSICS EXPERIMENTS
W. Kley 1968 29 p refs Presented at Intern. Conf. on the Util. of Res. Reactors and Reactor Math. and Compensation, Mexico City, 2–4 May 1967
(EUR-4082.E) Avail: CFSTI

The optimalization of neutron beam experiments at a pulsed reactor is treated. General criteria are defined for the characterization of neutron beams. For economic reasons, the design lay-out of all the neutron beam facilities is made under the concept to use, if possible, in an experiment all the neutrons in a collimated beam and to detect all the scattered neutrons whenever the geometrical conditions allow it. Consequently, most facilities are designed for the use of a white neutron beam and so-called "quasi-monochromatic neutrons". Combining time of flight and crystal spectrometer techniques, one can design coincidence-hybride-spectrometers that have similar performance characteristics as conventional triple axis spectrometers. Neutron guide tubes are used as design element for almost all facilities. Pulsed reactors with a thermal neutron peak flux equal to the constant flux of steady state reactors will be equal or better than steady state reactors for thermal neutron scattering experiments. For total cross section work in the energy range from thermal till some keV, pulsed reactors are superior to present day linear electron accelerators.
Author

N69-20993# Centre d'Etude de l'Energie Nucléaire, Mol (Belgium).
ANNUAL REPORT 1967 [RAPPORT ANNUEL 1967]
[1968] 50 p In FRENCH
Avail: CFSTI

The mission and composition of the Board of the C.E.N. are recalled and the researches carried out during 1967 are reviewed. Particular mention is made of the work with the BR1 and BR2 reactors and the sodium cooled experiments some of which were the subject of international cooperation. Theoretical work was carried out on the characteristics of metal oxides, ionic metals and crystals, low energy physics, pathology and radioactive isotopes.
ESRO

N69-21103# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
MEASUREMENTS OF PULSE SHAPES OF NEUTRON BURSTS IN THE THERMAL AND SUBTHERMAL RANGE AT SINGLE ENERGIES
G. Riccobono, G. Fraysse, and S. Menardi 1968 25 p refs
(EUR-4081.E) Avail: CFSTI

The time behaviour of neutron pulses was determined at single energies of 5, 20, 80 MeV, following the injection of fast neutron bursts in some moderator configurations at room temperature and at liquid nitrogen temperature. The experimental apparatus is described and its performances evaluated. The results are given and discussed from the point of view that the moderator configurations studied should serve as sources of thermal and cold neutrons when coupled to a pulsed fast reactor. Author

N69-21104# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.

THE INVESTIGATION OF FAST PULSED ASSEMBLIES USING THE MONTE CARLO METHOD [DIE UNTERSUCHUNG VON SCHNELLEN, GEPULSTEN ANORDNUNGEN MIT DER MONTE CARLO METHODE]

H. Kschwendt (Ph.D. Thesis—Graz Univ.) 1968 115 p refs In GERMAN; ENGLISH summary
(EUR-4087.D) Avail: CFSTI

The structure of the time dependent solution of the neutron transport equation is studied in small pulsed assemblies using the Monte Carlo method, which is specially suited for the description of short time behaviour. A large computer code was developed which treats all nuclear reactions of interest in slabs, spheres and cylinders and all types of spectra. Stationary fast leakage spectra show good agreement with experiments and S_n-calculations and a similar situation exists for the mean generation times. In one group cases, the time dependent decay of the neutron population is exponential but space dependent. For lead and copper blocks, the agreement between calculated and measured values is satisfactory, but a fundamental mode cannot appear. In the case of multiplying media, a fundamental mode can be observed as soon as the multiplication factor exceeds 0.9. Author

N69-21118# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

EFFECT OF PRIMARY U_3Si_2 PARTICLE SIZE DISTRIBUTION ON THE PERITECTOID REACTION IN URANIUM/SILICON ALLOYS

L. C. Berthiaume and B. S. Wyatt Dec. 1968 24 p refs
(AECL-3222) Avail: Atomic Energy of Can., Ltd., Chalk River. HC $1.00

The effect of the primary U_3Si_2 particle size on the transformation to U_3Si of as -cast U/Si alloys has been studied. The influence of the dispersion of fine U_3Si_2 particles in the eutectic matrix is also discussed. Samples of a U-4.0 wt% Si alloy were fabricated with particle sizes varying from 8–900 μm. It was found that only the samples having primary U_3Si_2 particles smaller than 30 μm could be fully transformed when heat treated at 800°C for 72 hours. The results suggest that uranium-silicon rods should be cast with as small a U_3Si_2 particle size as possible. One method of minimizing the particle size is to cool as quickly as possible from the melt during casting. Author

N69-21250# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).

IN-PILE CORROSION OF NUCLEAR MATERIALS Final Report

M.-J. Brabers, G. Spaepen, M.-J. Fevery-de Meyer, G. de Baere, and J. Meunier (Cebelcor) Brussels EURATOM 1969 74 p refs
(Contract EURATOM-055-65-3-TEEB)
(EUR-3796.e; EURAEC-2010) Avail: CFSTI

The research was mainly based on electrochemical corrosion methods, the usefulness of which was well-known from corrosion measurements at 25°C. These methods consist in measuring the different relationships between the factors electrode tension, electrode current and time. Usually an electrochemical cell with three electrodes was employed, namely, the measuring, the auxiliary and the reference electrode. An attempt was made to construct a typical three electrode cell in an irradiation zone and to check its behavior. Several electrochemical measuring methods were closely studied without irradiation at the same time in order to prepare the irradiation experiments. During the experimental work an overall result looked for was whether an irradiation effect could be found in experiments on aluminium, platinum and a few steels during reactor operation. Measurements were performed on samples which had been irradiated with a high irradiation dose. The behavior of non-irradiated samples in irradiated solutions was checked. A hypothesis was formulated which was verified in further experiments with gamma irradiation. Author

N69-21284# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

AN IRRADIATION FACILITY FOR IN-PILE MEASUREMENTS OF ELECTRICAL RESISTIVITY AT HIGHER TEMPERATURES UNDER VARIOUS NEUTRON FLUXES FOR OPTIONAL PERIODS

E. Lang and W. Schuele 1968 45 p refs
(EUR-4196.e) Avail: CFSTI

An irradiation facility installed on Ispra-1 reactor for in-pile measurements of electrical resistivity of fissile and nonfissile material is described. Samples are brought within capsules into the facility and can be irradiated at temperatures between 40 and 1000°C at positions of different neutron fluxes for optional periods. Insertion and extraction of capsules can be performed without shut down of the reactor. A detailed discussion of the shielding calculations is included. Measurements of the neutron flux and distribution inside the facility were performed. First operation experiences and some irradiation experiments on α-brass are briefly reported. Author

N69-21320# Farbenfabriken Bayer, A. G., Leverkusen (West Germany).

THE ANALYSIS OF ORGANIC COOLANTS FOR NUCLEAR REACTORS [DIE ANALYSE ORGANISCHER KUEHLMITTEL FUER KERNREAKTOREN ABSCHLUSSBERICHT] Final Report

F. Geiss, ed. Brussels EURATOM 1968 177 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-203-65-3-ORGC)
(EUR-4086.D) Avail: CFSTI

The determination of the following compounds was studied: ash, iron, nickel, boron, chlorine, sulphur, oxygen, water, and the organic main components. The report is divided into a first part treating a discussion of all methods studied, a second one presenting the results and critical discussion of a circular analysis, the third one giving the experimental conditions of recommended analyses. Another chapter gives a survey of the error statistics involved. Author

N69-21373# Aktiebolaget Atomenergi, Stockholm (Sweden).

NONLINEAR DYNAMIC MODEL OF POWER PLANTS WITH SINGLE-PHASE COOLANT REACTORS

Heinz Vollmer Dec. 1968 34 p refs
(AE-341) Avail: CFSTI

The traditional way of developing dynamic models for a specific nuclear power plant and for specific purpose seems rather uneconomical, as much of the information often cannot be utilized if the plant design or the required accuracy of the calculation is desired to be changed. It is therefore suggested that the model development may be made more systematic, general and flexible by: applying the 'box of bricks' system, where the main components of a nuclear power plant are treated separately and combined afterwards according to a given flow scheme, a dynamic determination of the components which is as general as possible without taking into account those details which have a minor influence on the overall dynamics; providing approximations of the more rigorous solution sufficient to meet the user's requirements

on accuracy proper use of computers. A dynamic model for single-phase coolant reactor plants is established along these lines. By separation of the nonlinear and linear parts of the system, application of Laplace transformation and proper approximations, and the use of a hybrid computer it seems possible to determine the (nonlinear) dynamic behaviour of such a plant for perturbations which are not so large that phase changes of physical parameters occur, e.g. fuel does not melt. The model is applied to a steam cooled fast reactor power plant. Author (ESRO)

N69-21398*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CONTROL SYSTEM STUDY FOR AN IN-CORE THERMIONIC REACTOR
Lynn E. Weaver, Henrik G. Gronroos, James G. Guppy, and Jerry P. Davis 15 Jan. 1969 67 p refs
(Contract NAS7-100)
(NASA-CR-100498; JPL-TR-32-1355) Copyright. Avail: CFSTI CSCL 18E

Conceptual reactor controllers for in-core thermionic reactor space powerplants were investigated by analysis and by analog simulation. The control system was specified to maintain constant output voltage at the reactor terminals, while minimizing the effect of electric load changes and internal and external disturbances. Using state-variable feedback design techniques and linearized system equations, constant feedback coefficients were determined so as to give the desired system response. The sensitivity to parameter variations and noise was evaluated. The controller design obtained by analysis of the linear model was applied to the corresponding nonlinear model simulated on analog computers. The correlation between the results predicted with the linear model and those obtained by the simulation was found to be good. The investigations were exploratory; however, it appears that an in-core thermionic reactor can be controlled by relatively simple means. Loss of controller feedback elements does not cause stability problems if the control signal is constrained. All results are obtained for constant-temperature current-voltage characteristics for the thermionic diodes that do not cross each other in the range of operating conditions. Author

N69-21415# Cekmece Nuclear Research Center, Istanbul (Turkey).
POLYMER-INCAPSULATION OF ACTIVITIES FROM WASTE SOLUTIONS ON ION-EXCHANGE AND ADSORBENT PARTICLES
M. Talat Erben, Envare Unseren, and Ali Yalcin 30 Sep. 1968 35 p refs Sponsored in part by IAEA
(CNAEM-61) Avail: CFSTI

Encapsulation of radioactive adsorbent and ion-exchange particles with polymers was investigated. Methyl acrylate, methyl methacrylate, styrene, acrylonitrile, methacrylonitrile, acrylic acid, and methacrylic acid was used. Copolymers were also studied. The best polymerization temperature is about 60°C with 1% benzolypetoxide as catalyst. Pure polystyrene becomes very brittle after irradiation. Methacrylonitrile polymerizes extremely slowly. Acrylonitrile leads to inhomogeneous products. Acrylic and methacrylic acids produce hydrophilic products which deteriorate when they come into contact with water releasing the incapsulated activity. Methyl acrylate, and methyl methacrylate produce spongeous products which are not suitable for incapsulation. Copolymers of stryene with acrylonitrile, methacrylonitrile, acrylic acid, and methacrylic acid have to be discarded for similar reasons. Styrene-methyl methacrylate copolymers show poor radiation stability. The best system among those studied seems to be styrene-methyl acrylate. Author

N69-21521# Kernforschungsanlage, Juelich (West Germany).
THE HIGH-TEMPERATURE GAS-COOLED AND ADVANCED GAS-COOLED REACTORS: LITERATURE SURVEY
Sep. 1968 714 p refs
(JUB-BIBL-14) Avail: CFSTI

Abstracts of a literature survey on advanced high-temperature gas-cooled reactors are presented. Subjects are grouped under the following headings: (1) the high-temperature gas-cooled reactors and advanced gas-cooled reactors, (2) concept study and patents, (3) reactor physics, (4) components, (5) structure materials, (6) technology, (7) fuels, (8) fuel elements, (8) reprocessing, (9) reactor safety, and (10) advanced studies. F.O.S.

N69-21881# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
OXIDATION AND HYDRIDING OF ZIRCALOY IN NPD REACTOR
A. S. Bain and J. E. Le Surf Jan. 1969 35 p refs
(AECL-3065) Avail: Atomic Energy of Can. Ltd., Chalk River: $1.00

In NPD reactors the materials and operating conditions pertinent to oxidation and hydriding are: fuel–UO_2 pellets; sheath–Zircaloy-2, but occasionally Ni-free Zircaloy-2 or Zircaloy-4; autoclaving–400°C steam for 20 hours; coolant–D_2O maintained at pH = 10 with LiOD; inlet temperature–250°C and single phase throughout; dissolved gases–initially, up to 20 ml D_2/kg D_2O but this gradually fell to < 0.5 ml D_2/kg D_2O. During operation oxygen is undetectable in the coolant, but samples of materials which are sensitive to oxidizing conditions exposed in an autoclave close to the reactor outlet have behaved as if the coolant was oxidizing. Deuterium analyses of the sheathing give unambiguous pick-up rates since there is no confusion between original hydrogen (H_2) in the sheath and the pick-up (D_2) during irradiation. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-20714 Duke Univ., Durham, N. C.
MAGNETIZATION AND SPIN WAVES IN NON-PLANAR THIN FILMS
Robert Bolling Roe, Jr. (Ph.D. Thesis) 1967 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-11215

An approximate method is presented for computing equilibrium magnetization and internal field distributions for magnetic thin films with nonplanar surfaces. The iterative calculation is based on a three dimensional model in which the surface topology of the film is assumed to be periodic along one of the film plane coordinates and uniform along the other. Each period of the film is subdivided into regions in which the magnetization and internal field are assumed to be uniform. A procedure is then established for computing the equilibrium direction of the magnetization and the magnitude and direction of the internal field within these regions. Computer calculations for simple configurations indicate that the nonplanar surfaces of thin films can cause significant variations in the internal field near the film surface for large applied fields. An examination of the standing spin wave equations for nonplanar films shows that characteristics of spin wave spectra previously explained on the basis of surface anisotropies and surface layers of reduced magnetization are explicable in terms of the internal field variations caused by the nonplanar surfaces of a thin film. Dissert. Abstr.

N69-20715# Toulouse Univ. (France). Faculté des Sciences.
ELECTRICAL CONDUCTION IN MUSCOVITE MICA [CONTRIBUTION ON A L'ETUDE DE LA CONDUCTION ELECTRIQUE DANS LES MICAS MUSCOVITES]
Alain Chapesu (Ph.D. Thesis) 21 Oct. 1968 80 p refs In FRENCH
Avail: CFSTI

The first part is devoted to a discussion of the simple mechanisms that can cause insulating materials to become conductive e.g. tunnel effect, Fowler – Nordheim effect, Schottky effect. Experiments designed to measure the conductivity on muscovite are described and the results are given. It is shown that the magnitude of the current in the mica depends on the nature of the impurity as well as on their density and distribution in a material. ESRO

N69-20759 California Inst. of Tech., Pasadena.
THE REFRACTIVE INDEX AND THE LORENTZ–LORENZ FUNCTION OF FLUID ARGON
Richard King Teague (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-12763

The refractive index, for λ_{Na} = 5893 Å, of dense fluid argon was measured by the determination of the angle of minimum deviation. The study covered states from 133° to 173°K for pressures 20 to 100 atm. The density data of J. Levelt were used to calculate values of the Lorentz–Lorenz function for these states. A prism cell with 1/4" diameter sapphire windows in a cryostat was used to contain the sample. The cell temperature was measured to ±0.015°K and controlled to ±0.001°K. The pressure was measured with a gage calibrated against a dead weight tester to ±0.06%. Dissert. Abstr.

N69-20870*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FORTRAN CODE FOR COMPUTING THE PRINCIPLE MASS MOVEMENTS OF INERTIA OF COMPOSITE BODIES
James E. Cake Washington Mar. 1969 38 p refs
(NASA-TM-X-1754) Avail: CFSTI CSCL 20K

A mathematical model of the mass characteristics of composite bodies has been programmed for digital computer processing. The description and equation development of the mathematical model are presented. The technique is of particular interest for spacecraft whose size or mass prohibits the use of experimental measurement in an inertia laboratory. The computer program is written in the FORTRAN IV (version 13) language and is operational on the IBM 7094 Direct Couple System. A sample problem illustrates the input data requirements and the output format of the program. The use options of the program and program limitations are fully described. Author

N69-20905*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLES OF MIE SCATTERING FUNCTIONS FOR PARTICLES WITH REFRACTIVE INDEX 1.5
M. P. McCormick and J. D. Lawrence, Jr. Washington Mar. 1969 55 p
(NASA-TN-D-5110) Avail: CFSTI CSCL 04A

Single-particle backscatter intensity functions and efficiency factors for spherical particles of refractive index 1.5 have been calculated by using rigorous Mie theory. The single-particle results have been integrated over a Junge size distribution of four laser wavelengths for a range of parameters representative of the atmospheric aerosol. The laser wavelengths are 1.0600 μm, 0.6943 μm, 0.5300 μm, and 0.3472 μm, corresponding to the output of a neodymium laser and ruby laser and their second harmonics, respectively. The Junge size-distribution parameters 2.50, 3.00, 3.50, and 4.00 and particle radii limits of approximately 0.04 to 3.00 μm, 0.04 to 10.00 μm, 0.08 to 3.00 μm, and 0.08 to 10.00 μm were used. Author

N69-20935# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ASPECTS OF THE MAGNETISM OF FERROUS CHLORIDE [ASPECTS DU MAGNETISME DU CHLORURE FERREUX]
Patrice Carrara (Ph.D. Thesis—Paris Univ., 27 Mar. 1968) Jul. 1968 178 p refs In FRENCH; ENGLISH summary
(CEA-R-3535) Avail: CFSTI

This critical review of the magnetism of ferrous chloride presents in addition a number of new experimental results. A careful analysis of the level structure of ferrous ions in the crystalline field shows that the crystalline anisotropy is of the same order of magnitude as the exchange interactions, a feature which gives rise to effects such as an upward curvature of the magnetization curve at 0°K in a perpendicular magnetic field. Further, the very low temperature (T>0,4°K) thermal variation of both the specific heat and magnetic susceptibility reveals a magnetic component in elementary excitations. This result suggests the presence of a large magneto-elastic coupling. Finally, an experimental study of the H-T phase diagram near T_N and of the critical behaviour of the specific heat and parallel susceptibility is discussed. Author (ESRO)

N69-20946 New Mexico Univ., Albuquerque.
A STUDY OF THE BACKSCATTER OF LIGHT FROM A SINGLE WATER DROPLET
Theodore Stauffer Fahlen (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-11655

The backscattered light from a single water drop is studied theoretically and experimentally for drop diameters of about one millimeter. The results of Mie's theory are applied to drops of size parameter (defined as the ratio of the drop circumference to the wavelength of the incident light) near 3000; this corresponds to a drop diameter of about one millimeter. Theoretically, it is shown that the backscattered light originates from the center of the drop and from the circumference of the drop. The backscattered intensity oscillates in magnitude as the size parameter of the drop changes monotonically. Several simple theories involving internal geometrical reflections as well as surface wave phenomena are discussed in an attempt to explain the origin and periodicity of the circumferentially backscattered light predicted by the Mie theory. The experiment confirmed the results of the theoretical work. Dissert. Abstr.

N69-20988 Cornell Univ., Ithaca, N. Y.
STIMULATED BRILLOUIN SCATTERING
Jules Walder (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11647

The characteristics of the Stokes light and the hypersound generated by the stimulated Brillouin scattering of ruby laser light in various liquids and fused quartz at room temperature are studied in detail experimentally. In the case of nonfocusing liquids such as n-hexane, methanol, and carbon tetrachloride, it is found that at room temperature the measured characteristics of the Stokes light agree well with calculated results obtained on the basis of the steady-state theory; all the constants needed in the calculation are available from completely independent measurements. A similar study is made of fused quartz at room temperature. The results on the Stokes intensity is also used to estimate the attenuation constant of the 24 Ghz hypersound in fused quartz at room temperature. Dissert. Abstr.

N69-20974# Library of Congress, Washington, D. C. Aerospace Technology Div.
LIGHT PROPAGATION IN A TURBULENT ATMOSPHERE
Surveys of Foreign Scientific and Technical Literature
Andrey Polushkin 19 Mar. 1969 36 p refs
(ATD-67-52) Avail: Issuing Activity

A comprehensive outline of recent Soviet research is presented. An attempt is made to trace the development of the major avenues of research as followed by the principal Soviet investigators. A biographical and organizational review of the Soviet research, dealing with the key personnel and institutions active in this area and with the major conferences, is given. The general subject of light intensity fluctuations is taken up in an historical sequence, with the most recent papers being stressed. The more specialized problems of image quivering, or fluctuations in the direction of propagation, and the interactions taking place within the observation system itself are treated. Materials on the propagation of laser beams in the atmosphere are discussed. In view of Tatarskiy's significance in Soviet research on the propagation of light in a turbulent atmosphere, a survey is made of his other publications, not directly pertinent, in order to shed additional light on his methods. Author

N69-21013 Stanford Univ., Calif.
INTERFACE MORPHOLOGY CONSIDERATIONS DURING SOLIDIFICATION
Lemuel Abraham Tarshis (Ph.D. Thesis) 1968 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-11360

The general concepts associated with interface shape stability are thoroughly described. The mathematical extensions of these ideas are chronologically reviewed to provide a foundation for certain particular considerations. The morphological stability of a planar interface is reexamined considering the effects of molecular attachment kinetics. Considerations are applied on a shape perturbation of an otherwise planar interface where all the pertinent physical factors, including all accepted kinetic mechanisms, are incorporated via a coupling equation. To generalize the results and to compare the effects, the previous stability criterion is modified. As a result, stability is specified in terms of a single parameter, Ξ^*, whose value was originally unity but which now is altered by these new considerations. In the limit of infinitely rapid kinetics, the general criterion reduces exactly to previous work where such kinetics were neglected. The results indicate that interface attachment kinetics, especially layer-source limited kinetics, indeed play an important role in the prediction of interfacial breakdown. Dissert. Abstr.

N69-21028 Texas Univ., Austin.
AN ANALTYICAL INVESTIGATION OF THE PERFORMANCE OF SMALL SOUND SOURCES IN PLANAR ARRAYS
Marilyn Ann Wang Andrulis (Ph.D. Thesis) 1968 193 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-10805

A computer simulated model of a low-frequency, multielement array of acoustically small piston projectors, mounted in an effectively infinite, rigid baffle, is developed, and the theoretical predictions are compared with the corresponding measurements made on a scale model. Multi-element planar arrays are studied in which all elements are connected electrically in parallel and have, respectively, the same resonance frequency in air and in water at infinite seperation distance. The array velocity distribution and the radiation loading that each piston experiences are investigated as functions of the array geometry, the element size, the operating frequency, the electrical drive and the mechanical resistances of the individual transducers. Dissert. Abstr.

N69-21058 Cornell Univ., N. Y.
A STUDY OF FOCUSING EFFECTS ON IONOSPHERICALLY REFLECTED RADIO WAVES
Leonard Claude Humphrey (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-11627

The focusing gain parameters associated with radio waves reflected obliquely from the ionosphere are derived theoretically and compared with experimental observations. The theoretical computations include a geometrical optics computation of the shape of the caustic surface, and a physical optics computation of the expected variation of the field in the vicinity of the caustic surface. The description of the field in the neighborhood of the caustic depends on the shape of the ionosphere with respect to the earth. For an ionosphere concentric with the earth and a surface location transmitter it is convenient to describe the focusing gain in terms of the elevation angle of arrival. Dissert. Abstr.

N69-21084 Stanford Univ., Calif.
PHOTOEMISSION STUDIES OF THE NOBLE METALS, THE CUPROUS HALIDES, AND SELECTED ALKALI HALIDES
Walter Frank Krolikowski (Ph.D. Thesis) 1967 420 p
Avail: Univ. Microfilms: HC $18.90/Microfilm $5.35 Order No. 68-11383

In order to test the validity of explanations for the optical spectrum of the cuprous halides, the electronic properties of the cuprous halides have been investigated in detail by use of experimental photoemission techniques. The quantum yield and photoemission data resulting from these photoemission measurements have been interpreted in terms of the electronic structure of the cuprous halides, and it is found that the copper d band plays a significant role in the valence band of the cuprous halides. In order to distinguish the copper d band from the halogen p bands in the cuprous halides, it was found useful to extend the photoemission studies to the noble metals and the alkali halides. Consequently, this report includes not only studies of the cuprous halides (CuCl, CuBr, CuI), but also detailed studies of the noble metals (Cu, Ag, Au) and certain alkali halides (CsCl, CsBr, CsI, and KI). Dissert. Abstr.

N69-21152*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
THERMALLY INDUCED ELECTROCONVECTION
J. Wong and J. R. Melcher 7 Feb. 1969 15 p refs
(Grant NGL-22-009-014)
(NASA-CR-100454; CSR-TR-69-3) Avail: CFSTI CSCL 20C

The combined effects of a thermal gradient and a dc electric field upon a poorly conducting fluid are used to induce steady convection. A natural, vertically-directed temperature gradient is used to establish an electrical conductivity gradient over the rectangular cross-section of a liquid-filled channel. Then a static potential, which varies either linearly or periodically along the channel, is imposed on electrodes that form the channel top. A similar potential, spatially shifted in the longitudinal (horizontal) direction, is applied at the bottom of the channel. These electrodes make physical and electrical contact with the fluid, which typically has a mean electrical conductivity of 10^{-10} mhos/m. Because of the conductivity gradient, the vertical component of the resulting electric field induces free charges in the bulk, and these charges are then pulled in the horizontal direction by the longitudinal component of the electric field. An analytical model is used to predict the distribution of potential, electric stress, and velocity. Author

N69-21191# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
MEASUREMENTS OF THE NOISE OF AIR JETS FROM SLOT NOZZLES WITH AND WITHOUT SHIELDS

F. R. Groesche Jul. 1968 32 p refs
(DLR-FB-68-46; AVA-FB-6802) Avail: CFSTI

A process of reducing jet noise by shielding the jet with suitable reflectors is proposed. Investigations of slot nozzle models with and without shields were carried out, and the dependence of noise radiation upon the distance between the jet axis and shield was found. A method to determine the distribution of noise sources along the jet engine was presented and results are given relating to the slot nozzle with and without shield. B.G.D.

N69-21225# State Inst. for Technical Research, Helsinki (Finland).
ON THE CONSTRUCTION OF A GENERATOR MAGNETIZED BY BARIUM-FERRITE MAGNETS
Vaeinoe Kelhae and Eino Sairio 1968 26 p refs
Avail: CFSTI

This paper presents a medium frequency generator magnetized by high coercive barium-ferrite magnets, of which the magnetomotive force is larger than that of coils of the same volume. The dimensions of the generator have been optimised. Calculations have been made for quantitative prediction of the degree of demagnetization of the permanent magnet field by armature current. The temperature dependence of the terminal voltage attributable to the temperature-sensitive barium-ferrite magnets has also been calculated. Compensation for the dependence was effected by pieces of iron-nickel alloy in accordance with analytical predictions. Author

N69-21304 New Mexico Univ., Albuquerque.
A FIVE DIMENSIONAL FIELD THEORY
Scott Holzhauser (Ph.D. Thesis) 1968 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-11659

The introduction of the fifth dimension to the classical field theory reveals many phenomena, the most important of which is that the fields at the center of a particle remain finite. This fact leads to a finite self-energy for the particle. The fields quickly approach the Coulomb potential as distance from the particle increases. Associated with the particle is a charge density which is a function of r, the charge being smeared out over a finite radius and attenuating rapidly for $r > a$ where a is on the order of 10^{-15} meters. The theory is developed from the assumption that the current and potential vectors have five components instead of the usual four, and that there are five space variables. The basic theory is developed entirely in tensor notation, so the formalism is automatically relativistically invariant. Dissert. Abstr.

N69-21339# National Physical Lab., Teddington (England). Div. of Optical Metrology.
STRESS IN OPTICAL THIN FILMS
P. B. Clapham and R. Reeves Oct. 1968 29 p refs
(NPL-OP-MET-3) Copyright. Avail: CFSTI

In an attempt to classify the assumptions made about stresses in thin films, and ultimately to control them, a cantilever stress measuring apparatus was built. Films were deposited under a variety of unusual conditions, such as electron irradiation of the substrate during deposition and also co-evaporation of a small proportion of an impurity material. The significance of a dozen different experiments are discussed and it appears that elevating substrate temperatures appears to be one of the most effective methods of lowering film stress. ESRO

N69-21393# Washington Univ., Seattle.
GEOMETRIZATION OF THE BRANS-DICKE SCALAR FIELD
P. C. Peters [1968] 8 p refs
(Grant NSF GP-7390)
Avail: Issuing Activity

The Brans–Dicke gravitational scalar field is geometrized in the spirit of the Rainich–Misner–Wheeler geometrization of electromagnetism. Geometric equations are derived which imply that the Brans–Dicke field is present, and an explicit expression is given for this field in terms of geometrical quantities. Author

N69-21615# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE INFLUENCE OF AN INTERMEDIATE BODY ON GRAVITATIONAL INTERACTION
V. B. Braginskii and V. K. Martynov Jun. 1968 19 p refs Transl. into ENGLISH from Vestn. Ser. 3: Fiz., Astron. (USSR), no. 2, 1966 p 60–68
(AD-681638; FTD-MT-24-136-68) Avail: CFSTI CSCL 20/10

The authors describe an experiment undertaken for the purpose of observing the influence of an intermediate body on the static gravitational interaction. The experiments were made with a torsion pendulum consisting of two identical masses (25 g each) and a tungsten wire. One mass served as a trial body and the other mass as part of a variable capacitor serving as a pickup for the oscillations. The torsion pendulum is kept in vacuum not worse than 0.0001 mm Hg. From the change in capacitance it was possible to deduce whether a third body changes the static gravitational force on the other body. The small changes in the oscillation amplitude were processed by means of a statistical method. TAB

N69-21626# Fairchild Hiller Corp., Farmingdale, N. Y. Republic Aviation Div.
STUDIES ON AN ELECTRIC DISCHARGE UNDERWATER SOUND SOURCE Final Technical Report, 1 Dec. 1964–31 Oct. 1968
William J. Guman and Burton G. Humphrey, Jr. 31 Dec. 1968 108 p refs
(Contract Noor-4741(00))
(AD-681862; FHR-2229-7; PCD-TR-68-16) Avail: CFSTI CSCL 20/1

Operation of the inverse pinch geometry in underwater electrical discharges, viewed as acoustic sources, has been evaluated. The basic characteristics of the signal radiated (e.g., distance dependence, waveform, etc.) are similar to general underwater discharges and explosive sources. Critical dependence of the energy efficiency on the electrical damping characteristics of the discharge circuit (including the discharge itself) was found. However, high speed optical investigations disclosed that, under the achievable energy and configuration limitations, it was not possible to produce a discharge of the desired cylindrical symmetry. Auxiliary investigations demonstrated that the configuration produced satisfactory strong (arc-like) discharges in water equivalent in salinity to sea water; however, the increased energy loss during initiation of the arc, due to the higher conductivity of the water, tended to decrease overall efficiency in saline solutions. It was also demonstrated that near field acoustic signals may be shaped to a considerable extent by tailoring the waveform of the electrical discharge (with significantly decreased energy efficiency, however). Author (TAB)

N69-21630# School of Aerospace Medicine, Brooks AFB, Tex.
COMPARISON OF SPEECH RECORDINGS IN ROOM AIR AT GROUND LEVEL AND IN HELIUM-OXYGEN MIXTURE AT SIMULATED ALTITUDE Final Report, Sep. 1964–May 1966
S. Joseph Barry and James E. Endicott Nov. 1968 13 p refs
(AD-682284; SAM-TR-68-118) Avail: CFSTI CSCL 17/2

Articulation functions associated with two 50-item lists of phonetically balanced speech materials of demonstrated equivalence were compared for a single male talker under two

different atmospheric conditions. One set of materials was recorded in an atmosphere of ordinary room-air composition at ground level, and the other in a helium-rich atmosphere maintained at a simulated altitude of 18,000 feet. In the two sets the articulation functions resembled each other closely in slope and configuration; however, the fact that the helium-speech function was somewhat displaced along the abscissa represented an increase in sensation level. Therefore, at presentation levels below those which produce near-maximum intelligibility, the helium-speech materials required about a 6 db increase in intensity to achieve intelligibility equal to that of room-air speech. Author (TAB)

N69-21641# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

ANGULAR AND WAVELENGTH DEPENDENCE OF THE LIGHT SCATTERED FROM A CLOUD OF PARTICLES FORMED BY HOMOGENEOUS NUCLEATION

Gilbert D. Stein Dec. 1968 18 p refs

(Contract Nonr-609(47))

(AD-682227; TR-12) Avail: CFSTI CSCL 20/6

Details of the features of light scattering from ice particles formed via condensation by homogeneous nucleation are presented. An argon-ion laser is used and the results indicate that dipole or Rayleigh scattering is applicable to the situation under study. In addition, measurements of the number and the mean radius of the particles are made. Author (TAB)

N69-21694# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

REVIEW OF SOME ACOUSTICAL SOURCE PROBLEMS AND FAR FIELD INTEGRATION METHODS

E. W. Graham and B. B. Graham Apr. 1968 58 p refs

(AD-682118; D1-82-0788) Avail: CFSTI CSCL 20/1

The report is intended as preparation for studying problems of sound refraction by velocity discontinuities or gradients. One ultimate application might be to the refraction of jet noise as it passes from the moving jet into still air. Fourier integral methods are applied to the construction of stationary and moving acoustical sources. A variation of the method of stationary phase is used for evaluation of the far field integrals. Author (TAB)

N69-21712# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GENERATION IN RUBY AND NEODYMIUM GLASS WITH AXICON PUMPING

K. I. Krylov, N. E. Averyanov, A. S. Mitrofanov, A. S. Ter-Pogosyan, and S. F. Sharlai Mar. 1968 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 10, no. 4, 1967 p 9–11

(AD-681672; FTD-HT-23-197-68) Avail: CFSTI CSCL 20/5

This work investigates generation in ruby and neodymium glass rods in an axicon illuminator. A comparison with dense pumping showed that the effectiveness of the axicon illuminator was lower, although the structure of the field of the output emission was more uniform and the angular divergence was less. The effectiveness increased as the lamp diameter was reduced. TAB

N69-21753# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REPORTS OF THE CONFERECNE ON NOISE ABATEMENT AND VIBRATIONS BY METHODS OF STRUCTURAL ACOUSTICS (SELECTED ARTICLES)

L. M. Lyamshev et al Aug. 1968 16 p refs Transl. into ENGLISH from the book "Soveshchanie po Borbe s Shumami i Vibratsiyami Metodami Stroitelnoi Akustiki, Chelyabinski" Moscow, 1966 p 54–58; 256–258

(AD-681633; FTD-HT-23-102-68) Avail: CFSTI CSCL 20/1

Contents: Scattering and emission of sound by elastic plates and shells in a moving medium; Approximate calculation of sound insulation of light multilayer constructions with the use of M-20 machines. TAB

N69-21810# Technische Hochschule Munchen (West Germany).

TURBULENT NOISE STUDIES. [UNTERSUCHUNGER UEBER DEN TURBULENZLAERM]

Oskar Bschorr (Ph.D. Thesis) 1968 58 p refs In GERMAN

Avail: CFSTI

The magnitude and the spectrum of noise caused by turbulence are determined. It is assumed that a homogeneous, isotropic, and quasi-stationary turbulence field is subject to a canonical distribution. This postulation permits the application of concepts and solutions of statistical thermodynamics to a turbulent field. Specifically, a turbulence temperature, a turbulence entropy, and concepts analogous to the first and second laws of thermodynamics are introduced. The work is limited to the acoustic component of turbulence. Results for the linearized case are presented concerning increases in volume, frequency, and intensity, and for the relationship between spectral emission and absorption coefficients. Transl. by K.W.

N69-21839# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.

RECOVERY IN COPPER AFTER FATIGUE AT 78K

A. K. Eikum and I. Holwech Dec. 1968 11 p refs

(AD-682124; D1-82-0801) Avail: Issuing Activity CSCL 11/6

The report describes some observations on the recovery behavior of pure copper following cyclic deformation at liquid nitrogen temperature. The isochronal spectrum consists of four main recovery stages which are centered at approximately -140, -30, 70 and 300C. Possible recovery mechanisms are briefly discussed. Author (TAB)

N69-21848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INVESTIGATION OF THE DISTRIBUTION OF THE SPECIFIC ENERGY OF A SHOCK WAVE FORMED DURING THE ELECTRICAL EXPLOSION OF A WIRE AND ELECTRICAL DISCHARGE IN THE AIR

Yu. I. Protasov, V. G. Bondarenko, and D. M. Migunov Feb. 1968 10 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Fiz. (USSR), v. 10, no. 5, 1967 p 110–112

(AD-682108; FTD-HT-23-1586-67) Avail: CFSTI CSCL 19/1

The effects of the length of the discharge gap and the length and diameter of the wire on the rise and the attenuation of the shock energy at different points around the source were considered. The measurements were carried out by a ballistic pendulum, with an optical goniometer for measuring the pendulums angle of deviation from the vertical. The mass, length, and surface area of the pendulum being known constants, the energy was calculated as a function of the deviation angle. The specific shock energy as a function of the distance from the axis at various discharge gap lengths shows energy maxima at a distance from the axis. The distance of these maxima increases with the gap length, while their peak value decreases. In the case of an exploding wire, the maximum coincides with the axis, i.e., the wire. The energy distribution along line parallel to the axis shows one maximum opposite the middle of the gap lengths up to 3 cm and two symmetrical maxima at a gap length of 4 cm and over. Author (TAB)

N69-21883# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
DIELECTRIC CONSTANT AND POLARIZABILITY DETERMINED FOR SOLID PARAHYDROGEN
Repr. from NBS Tech. News Bull., Jul. 1968 p 146–147 ref
(PB-180895; R-462) Avail: CFSTI CSCL 20M

Recent research on the physical properties of materials at low temperatures has resulted in the first accurate determination of the dielectric constants of solid parahydrogen. The dielectric-constant values were then used, together with hydrogen density values available in the literature, to calculate accurate values for the polarizabilities (more properly termed the Clausius–Mossotti function) of solid parahydrogen. All measurements of solid parahydrogen were made on the melting line, or phase boundary of the liquid and solid hydrogen, at pressures between 18 and 320 atmospheres and temperatures between 14.4 and 22.2 K. Author (USGRDR)

N69-21905# California Univ., Los Angeles. Dept. of Engineering.
SCATTERING OF WAVES BY PENETRABLE OBJECTS
Technical Report, 1 Feb. 1968–31 Jan. 1969
C. Yeh Jan. 1969 23 p refs
(Contract N00014-67-A-0111)
(AD-681702; REPT-69-2) Avail: CFSTI CSCL 20/1

Three problems were considered: (1) Focusing by liquid elliptical lens, (2) Scattering by coated prolate spheroids, and (3) Diffraction of sound waves by a moving fluid cylinder. A discussion on all these problems is given. Author (TAB)

N69-21907# California Inst. of Tech., Pasadena. Lab. of Engineering Materials.
HALL EFFECT IN AN AMORPHOUS FERROMAGNETIC ALLOY
W. M. Keck Jul. 1968 12 p refs
(Contract AT(04-3)-221)
(PB-180851; CALT-221-53) Avail: CFSTI CSCL 20/3

A study was made of the Hall effect in an amorphous FePC alloy. USGRDR

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-20830 Yale Univ., New Haven, Conn.
MANY ELECTRON EFFECTS IN ATOMS
Bolesh Stanley Joseph Skutnik (Ph.D. Thesis) 1968 237 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-13203

A many electron theory extension to non-closed shell systems was used to deal with three related areas of the many-electron problem. The transformation properties of two-electron energies are investigated. Neon was chosen as a model system. Earlier results on the Hartree–Fock two-electron terms were confirmed and the major new result of this study is that inter-orbital correlation energies are not necessarily negligible as was earlier assumed. The main features of non-closed shell many electron theory are investigated and the correlation effects peculiar to these systems are evaluated for various states of carbon, nitrogen and oxygen. This information is used to obtain quantities of interest in atomic spectroscopy, such as term level splittings, transition energies and ionization potentials. Methods of atomic spectroscopy are applied to predict transitions for fractionally charged species in stellar spectra. Dissert. Abstr.

N69-20884 Johns Hopkins Univ., Baltimore, Md.
SOME MODEL STUDIES OF THE QUANTUM THEORY OF THE UNIMOLECULAR RATE CONSTANT
Robert Bagwell Frey (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-10566

An expansion of the quantum evolution operator in terms of quasi-stationary energy eigenfunctions is introduced and applied in model calculations. Its use greatly simplifies dynamical calculations in a limited region of space, especially for systems having a long lifetime. The Thiele–Wilson quantum formalism for the unimolecular rate constant is considered in model calculations. The expansion is found to be very useful in evaluating the rate constant and in general considerations. It is suggested that the critical surface be placed at the minimum of the envelope of the quasi-stationary eigenfunctions and that a reasonable initial density matrix can be expressed in terms of quasi-stationary states. Quantum analogues to the classical equilibrium hypothesis and random gap hypothesis are proposed. Dissert. Abstr.

N69-20889# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
UNPAIRED-ELECTRON DISTRIBUTION IN $MnPt_3$
B. Antonini, F. Lucari, F. Menzinger, and A. Paoletti 1968 26 p refs
(RT/FI(68)56) Avail: CFSTI

The magnetic electron distribution in $MnPt_3$ ferromagnetic alloy has been determined by polarized neutron diffraction. The Mn magnetic form factor in ferromagnetic state has been determined for the first time. It has been found to be very close to the one calculated for Mn^{2+}. The magnetic moment on Mn has been found to be 3.69 ± 0.07 μ_B, the one on Pt 0.15 ± 0.05 μ_B, in fair agreement with previous measurements performed on powdered samples. The magnetic electron distribution on Pt sites has been found highly anisotropic. Author

N69-20903 Louisiana State Univ., Baton Rouge.
APPLICATION OF THE ONE-CENTER EXPANSION TECHNIQUE. 2: NEAREST-NEIGHBOR LATTICE STATISTICS
Leon Lamar Combs (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10727

The technique of the one-center expansion method is explicitly illustrated for the molecule-ions HeH^{++} and HeH^{+} using one- and two-term wavefunctions consisting of Slater-type orbitals. Energy and electron density calculations are presented as a function of the internuclear separation and the expansion point. These are compared with the analogous calculations using the helium atom as the expansion point. Dipole moment calculations for HeH^{++} indicate that determination of the optimum expansion point is worth the extra work required when the wavefunction is only a Slater 1S orbital. The square and triagular "lattice gas" problems were solved. The interaction included in these calculations was an infinite repulsion between molecules residing at neighboring sites. Reported data include graphs of the equation of state, heat capacity and compressibility for all lattice widths studied. Dissert. Abstr.

N69-20953 Illinois Univ., Urbana.
CLASSICAL ROTATIONAL-TRANSLATIONAL ENERGY TRANSFER USING VARIATION OF CONSTANTS

Audrey Owen Cohen (Ph.D. Thesis) 1968 238 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-12095

New integral and purely analytical expressions are developed for classical mechanical rotational–translational energy transfer in molecular collisions. A variation of constants method is employed. These solutions are developed for both the collision of an atom with a rigid rotor and the collision of two rigid rotors. Variation of constants had been used previously in celestial mechanics but not in molecular rotation–translation energy transfer. The integral expressions for this energy transfer are derived by first expressing the angular motion of the particles in an elastic collision in terms of the constants of the motion. For an inelastic collision these constants become slowly varying functions of time which are the solutions of a set of coupled differential equations. When the constants of the motion on the right hand sides of these quations are approximated by their initial values, useful integral expressions are obtained for the changes in the components of the rotational and of the orbital angular momenta. Dissert. Abstr.

N69-20957 Delaware Univ., Newark.
THE RADII OF GYRATION OF AND LIGHT SCATTERING FROM SOME POLYMER STRUCTURES
Gary William Ver Strate (Ph.D. Thesis) 1967 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-13172

The configurational behavior of macromolecules in solution is studied along with the physical phenomena resulting from the various shapes the molecules attain. A perturbation theory is applied to obtain the magnitude of the expansion of certain macromolecules in dilute solution as caused by the excluded volume effect. The introduction of a ring into a branched structure greatly increased the magnitude of the expansion. The angular dissymmetry of light scattered from molecular structures is calculated and the equations for a double ring system are developed. Large angle scattering can be useful in the elucidation of molecular geometry. An empirical distribution function is devised to depict the distribution of distances between the segments of a macromolecule. A brief study of the properties of the distribution function is made and the equation for the angular dissymmetry of light scattered by a molecule described by this function is developed. Dissert. Abstr.

N69-20979# International Centre for Theoretical Physics, Trieste (Italy).
ON THE PROCESS NN → NN$_\pi$ NEAR THRESHOLD
R. Baier and H. Kuhnelt Dec. 1968 10 p refs Submitted for publication
(IC-68-111) Avail: CFSTI

Pion threshold production in nucleon-nucleon collisions is studied by two different approaches. After a new and simple derivation of the Adler-Dothan theorem the 0 production is calculated. The results are comparable to other calculations. Then the effective Lagrangian method is used and an agreement with experiment for X0 production achieved. The cross-section for pn ppX− is too high by a factor of 3–4. Author (ESRO)

N69-20984 Florida State Univ., Tallahassee.
GENERALIZED SUSCEPTIBILITY THEORY
Malcolm Wadsworth Chase, Jr. (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-11674

A general theory is developed in two stages of refinement for the linear response of an interacting molecular system to an external electromagnetic field. The exact ground state of the system is expressed in terms of the uncoupled molecule (zeroth-order) state by means of adiabatic time-dependent perturbation theory. Including the external field to first order the time-development operator leads to an infinite order expansion of the linear response function for physical quantities such as current-charge density and electric-dipole polarization. At the first stage of development two basic approximations involve partial decorrelation of charge motion and spatial separability of the molecules. At the second stage, by analogy with the many-body theory, proper two molecule terms are included. These terms take into account excited state interactions. Dissert. Abstr.

N69-20990# International Centre for Theoretical Physics, Trieste (Italy).
CURRENT ALGEBRAS, SUM RULES AND CANONICAL FIELD THEORIES
C. Cocho, C. Fronsdal, and R. White Dec. 1968 41 p refs Submitted for publication
(IC-68-106) Avail: CFSTI

A very large class of c-number Lagrangian field theories, called canonical field theories - being all theories whose field equations have sufficiently many solutions - satisfy a number of important completeness relations. These ensure the existence of Gell-Mann current algebras and Fubini sum rules, and guarantee that canonical field quantization is possible. Finite-component, first and second order Lagrangians in general, and a class of fourth order Lagrangian have been studied. The work is intended as preliminaries to an investigation of infinite component field theories. Author (ESRO)

N69-21027# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
FAST NEUTRON RADIATIVE CAPTURE
G. Longo and F. Saporetti 25 Nov. 1968 35 p refs
(RT/FI(68)55) Avail: CFSTI

An attempt is made to give a concise account of results achieved in the investigation of the (n,γ) reaction in the 1 to 20 MeV energy range for medium and heavy nuclei. The outlines of the models are given, and the available experimental data are briefly reviewed. The results of the analysis, carried out on the basis of the compound nucleus, the direct, and the semidirect capture models, are discussed. Author

N69-21048# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
BEHAVIOR OF THE PRODUCTS OF FISSION IN FUELS [COMPORTAMENTO DEI PRODOTTI DI FISSIONE ENTRO IL COMBUSTIBILE]
R. S. Nelson 1968 26 p refs
(RT/MET(68)4) Avail: CFSTI

The details of the seminar held by R. S. Nelson (U.K.A.E.A.) on the behavior of fission products inside the fuel at the Casaccia Center are presented. Author

N69-21049# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
EVALUATION OF NEUTRON SPECTRA BY ACTIVATION MEASUREMENTS OF SPECTRAL INDEXES
F. Pistella 5 Nov. 1968 62 p refs
(TR/FI(68)49) Avail: CFSTI

Two different methods, devised for spectrum evaluation by means of spectral indexes, are described. According to the first scheme, a shape can be numerically inferred for the spectrum; a guess distribution is modified so that the measured values of the spectral indexes, and possible auxiliary conditions, are reproduced. In the second scheme, a direct correlation between spectral indexes

and the reaction rate to be investigated is established; a range of possible values is determined for the unknown reaction rate by measured activation rate only, with no evaluation of the spectrum actually present in the assembly. Author

N69-21081*# Lockheed Electronics Co., Houston, Tex.
MATRIX ELEMENTS OF THE SPIN-SPIN INTERACTIONS FOR f^4 CONFIGURATIONS
J. A. Barnes, B. L. Carroll, and L. M. Flores Feb. 1969 12 p refs
(Contract NAS9-5384)
(NASA-CR-99598) Avail: CFSTI CSCL 20H

The spin-spin matrix elements for f^4 electron configurations are computed and tabulated for general usage. Author

N69-21156# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
INTEGRAL CROSS SECTION AND ESTIMATE OF CASCADE RATIO FOR 14 MeV NEUTRON CAPTURE
F. Cvelbar, A. Hudoklin, M. V. Mihailovic, and M. Potokar Oct. 1968 6 p refs
(NIJS-R-545) Avail: CFSTI

Integrated cross sections for radiative capture of 14.1 MeV neutrons in natural targets of P, Cu, In, and I are presented, and the experimental cascade ratios ($\sigma_{exc}/\sigma_{tot}$-1) are extracted for seven elements: Al, P, V, Mn, Cu, In, and I. Author

N69-21162# Australian National Univ., Canberra. Research School of Physical Sciences.
ANGULAR CORRELATION STUDIES OF THE REACTION Mg-24 (α,pγ) Al-27
K. W. Carter, R. V. Elliott, D. C. Kean, and R. H. Spear [1968] 24 p refs
(ANU-P/428) Avail: CFSTI

The 3.68, 3.96, 4.05 and 4.58 MeV levels of ^{27}Al were studied via angular correlation measurements. The results were in conjunction with previous information on lifetimes and branching ratios to impose limitations on possible spins, parities and multipole mixing ratios. New information on the gamma-ray decay scheme of the 4.58-MeV level is presented. Author

N69-21166 European Organization for Nuclear Research, Geneva (Switzerland).
INDUCED RADIOACTIVITY IN THE EARTH SHIELDING ON TOP OF HIGH-ENERGY PARTICLE ACCELERATORS
F. E. Hoyer 9 Dec. 1968 19 p refs
(CERN-68-42) Copyright. Avail: Issuing Activity

A study was made of the activity of radionuclides having half-lives longer than two days, that are produced in the earth shielding of high-energy particle accelerators; the CERN 28 GeV Proton Synchrotron was taken as a representative example. Measurements were restricted to ^{22}Na and ^{45}Ca for reasons of counting techniques, chemical treatment, and relative hazard. Up to 2 pCi/g ^{45}Ca and 6.9 pCi/g ^{22}Na were measured. The concentrations determined at different locations were compared with calculations using experimental neutron flux data, and a good agreement of both values was found. It was concluded from the measurements that no hazard exists as far as activity concentration of the effluent drainage water or manipulation of the earth from the shielding during shut-down periods is concerned, at least when working conditions such as those of the CERN Proton Synchrotron are maintained. However, secondary particle fluxes increase considerably for improvements of proton intensity and target efficiency at 28 GeV/c proton energy or for a larger 300 GeV/c proton accelerator. For that case it can be shown from the data presented that a certain hazard due to ^{22}Na and ^{45}Ca concentration even for the effluent drainage water cannot be ruled out. Author

N69-21203# Australian National Univ., Canberra. Dept. of Nuclear Physics.
OPTICAL MODEL ANALYSIS OF 29 MeV He-3 DIFFERENTIAL CROSS SECTION AND TOTAL REACTION CROSS SECTION DATA
D. J. Baugh [1968] 26 p refs
(ANU-P/427) Avail: CFSTI

Differential cross sections and total reaction cross section measurements for ^{3}He ions scattered by Mg, Al, ^{56}Fe, ^{63}Cu and Ag targets have been analysed using the optical model. Discrete and continuous ambiguities are discussed. The inclusion of reaction cross section measurements did not significantly resolve these ambiguities. Author

N69-21213# International Centre for Theoretical Physics, Trieste (Italy).
ON A LOCAL QUASIPOTENTIAL EQUATION WITH LOCAL INTERACTION
M. Freeman (JINR, Dubna), M. D. Mateev, and R. M. Mir-Kasimov (JINR, Dubna) Dec. 1968 43 p refs Submitted for publication
(IC-68-110) Avail: CFSTI

A relativistic equation of quasipotential type with local interaction is studied. With the help of the method of varying constants, integral equations for the wave functions of the continuous spectrum are obtained and Jost functions are introduced. In the exactly solvable cases of square well potential and Coulomb potential the analytical properties of the scattering matrix are investigated. Author (ESRO)

N69-21220# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
CALCULATION OF THE RADIATION DOSE INSIDE A SATELLITE WITH A DEFINED STRUCTURE TAKING INTO CONSIDERATION THE PITCH ANGLE DISTRIBUTION OF THE RADIATION [BERECHNUNG DER STRAHLENDOSIS IM INNERN EINES SATELLITEN UNTER BERUCKSICHTGUNG DER STRUKTUR DES SATELLITEN UND DER WINKELVERTEILUNG DER STRAHLUNG]
K. Wohlleben, R. Baeuerlein, and H. Riekert Bad Godesberg, West Germany Bundesministerium fuer Wiss. Forsch., Jan. 1969 34 p refs In GERMAN; ENGLISH summary
(BMwF-FB-W-69-03) Avail: CFSTI

The possibilities of isotropic and anisotropic radiation are covered. The ALGOL program SATSTRUKTUR, based on this method, is described. This program can be used for calculating the radiation dose rate for symmetric-axis satellite structures of random configuration and rotation-symmetric pitch angle distribution. Results of the dose-rate calculations for the Azur satellite are given. Author

N69-21228# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
PROTON-PROTON AND PROTON-LATTICE INTERACTIONS IN ICE
P. Gosar Sep. 1968 17 p refs
(NIJS-R-542) Avail: CFSTI

The migration of Bjerrum L-defects caused by thermally activated rotations of the adjacent water molecules is investigated. It is shown that the activation energy for the rotation can be transferred from one molecule to another due to the proton-proton interactions. Several models for the rotational collisions are presented. A short discussion of the dissipation of the activation energy to the lattice is given too. Further, the effect of the multiple rotational collisions on the dielectric relaxation is studied. Author

N69-21227# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
PROTON SPIN-LATTICE RELAXATION STUDY OF THE LIQUID CRYSTAL TRANSITION IN p-ANISALDAZINE
R. Blinc, G. Lahajnar, I. Levstek, D. E. O'Reilly, and E. M. Peterson Oct. 1968 6 p refs
(NIJS-R-543) Avail: CFSTI

The proton spin-lattice relaxation time (T_2) has been studied in the isotropic liquid, nematic liquid and polycrystalline solid phase of p-anisaldazine. The discontinuities in T_1 at the phase changes and the anomalous temperature behavior throw some new light on the molecular rearrangement and hetero-phase fluctuations connected with the onset of the nematic state. Author

N69-21248# European Atomic Energy Community, Ispra (Italy). Experimental Neutron Physics.
INELASTIC SCATTERING OF NEUTRONS BY LOCALIZED VIBRATIONS OF INTERSTITIAL HYDROGEN IN METAL LATTICES. CASE OF A VANADIUM LATTICE
G. Blaesser, J. Peretti, and G. Toth 1969 41 p refs
(EUR-4216.e) Avail: CFSTI

The contribution of the localized vibrations of hydrogen atoms in a vanadium lattice to the inelastic neutron scattering is calculated on the basis of Fine's model for the interaction within the lattice. A new method is used for the determination of the frequencies of the localized modes which avoids the solution of a secular determinant. Author

N69-21276# Australian National Univ., Canberra. Research School of Physical Sciences.
ON THE EFFECT OF THE STATISTICAL COMPOUND NUCLEUS PROCESS IN ELASTIC SCATTERING MEASUREMENTS
P. J. Dallimore [1968] 9 p refs
(ANU-P/424) Avail: CFSTI

The errors in elastic scattering cross section calculations due to a statistical compound nucleus component are investigated. It is found that the spin of the target nucleus is a major parameter in the estimation of these errors. Author

N69-21277# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
IONIZATION INSIDE A SATELLITE DUE TO THE BREMSSTRAHLUNG PRODUCED BY THE ELECTRON COMPONENT OF THE VAN ALLEN RADIATION [IONISATION DURCH DIE VON DER ELEKTRONENKOMPONENTE DER VAN-ALLEN-STRAHLUNG ERZEUGTE ROENTGENBREMSSTRAHLUNG IM INNERN EINES SATELLITEN]
R. Baeuerlein Bad Godesberg, West Germany Bundesministerium Fuer Wiss. Forsch. Jan. 1969 33 p refs In GERMAN; ENGLISH Summary
(BMwF-FB-W-69-04) Avail: CFSTI

A method is described for determining the ionization occurring in a semiconductor component behind a shield of given mass thickness due to the bremsstrahlung produced in the outer skin of a satellite by the electron component of the Van Allen radiation. With a typical electron spectrum, the ionization due to the bremsstrahlung is generated predominantly by low-energy electrons. Compared with the ionization due to direct radiation, the ionization in the inner Van Allen belt due to bremsstrahlung is negligible, whereas in the range of the outer radiation belt it predominates from mass thickness of several g/cm^2 onwards. Author

N69-21279# Technische Hochschule Munchen (West Germany). Fakultaet Fuer Allgemeine Wissenschaft.
INVESTIGATION OF GAMMA RAYS OF ORIENTED NUCLEI [UNTERSUCHUNG VON GAMMA-STRAHLUNG ORIENTIERTER KERNE]
Hermann R' Dobler (Ph.D. Thesis) 1968 21 p refs in GERMAN
Avail: CFSTI

Described is a cryogenic apparatus for gamma radiation measurements on radioactive nuclei that have been polarized by imbedding in ferromagnetic lattices at cryogenic temperatures. Measurements on the osmium 191 nucleus establish the magnetic fission moment for the isomeric h 11/2-level as: $\mu(h\ 11/2) = (4.08 \pm 0.18)\mu_K$. Measurements on platinum 191 established the magnetic ground level moment in a 1280 kG field as: $(0.71 \pm 0.08)\ \mu_K$. Transl. by G.G.

N69-21306# Australian National Univ., Canberra. Research School of Physical Sciences.
THE SPIN OF THE 2.78 MeV STATE IN Ne-19
D. J. Baugh, J. Nurzynski, D. M. Rosalky, and C. H. Osman [1968] 6 p refs
(ANU-P/430) Avail: CFSTI

The $^{20}Ne(^3He,\alpha)^{19}Ne$ reaction was studied at 10 and 15 MeV bombarding energy. A Distorted Wave Born Approximation analysis was performed indicating an $l = 4$ or $l = 5$ transition to the 2.78 MeV state in Ne^{19}. Author

N69-21336# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
ANISOTROPIC PROPERTIES OF NEUTRONS EMISSION FROM A PLASMA FOCUS
F. Cipolla Jul. 1968 16 p refs Sponsored in part by EURATOM
(LGI-68-23) Avail: CFSTI

It has been known since earlier experiments on fast high power discharges that the energy spectrum of neutrons emitted in such discharges is anisotropic, and more precisely that the neutrons emitted in the direction of the cathode carry more energy than those emitted in the direction of the anode. The technique used in these experiments is based on the range measurements of recoil protons in nuclear emulsions. By measuring the shift of the energy peak in these two directions, some conclusions can be drawn about the mass center (M.C.) velocity of the two colliding deuterons (if so) but still one cannot say anything with regard to the relative motion of the particles. In this paper an analysis is made of the possibility of obtaining this information by measuring the energy and activity at the directions corresponding to the anode, the cathode and at a right angle from them. Author (ESRO)

N69-21338# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
SUM RULES FOR NON-LOCAL POTENTIALS
A. Montes Dec. 1968 17 p refs
(Rept-68/42) Avail: CFSTI

Sum rules previously obtained for local potentials of finite range are demonstrated for non-local potentials of finite range. An estimate of the deviation from the sum rules for potentials decreasing exponentially at infinity is also considered. Author

N69-21353*# Wisconsin Univ., Madison.
THE VARIATIONAL PRINCIPLE AND THE VARIATIONAL METHOD
Saul T. Epstein 20 Feb. 1969 81 p
(GRANT NGL-50-002-001)
(NASA-CR-100495; WIS-TCI-338) Avail: CFSTI CSCL 20J

The variational principle is discussed in terms of the Hamiltonian of the internal dynamics of a bound system. The

starting point is the assumption that the average energy value is not less than the ground state. It is shown that the variational method and perturbation theory are used to approximate the solution of finite matrix problems. Considerations of the linear variational parameters (LVP) are presented in detail, and the excited state bound derived by using only LVP is compared to that of an imposed orthogonality on the LVP. F.O.S.

N69-21368# International Centre for Theoretical Physics, Trieste (Italy).

THEORY OF RELATIVISTIC H-ATOM AND POSITRONIUM

A. O. Barut and A. Baiquni 1969 11 p refs Submitted for publication

(IC-69-3) Avail: CFSTI

It is shown that a relativistic infinite-component wave equation correctly describes the relativistic effects in the H-atom including the motion of the nucleus. An exact mass formula for the singley, $l = n - 1$ levels of positronium is derived. Author (ESRO)

N69-21369# Aktiebolaget Atomenergi, Stockholm (Sweden).

A STUDY OF THE RESONANCE INTERACTION EFFECT BETWEEN ^{238}U AND ^{239}Pu IN THE LOWER ENERGY REGION

H. Hagglom Dec. 1968 49 p refs Submitted for publication

(AE-344) Avail: CFSTI

An investigation has been made of the statistical frequency function for the distances between the ^{238}U and the ^{239}Pu resonances in the region 4-244 eV. It is concluded that the frequency function is probably constant but that the distances diverge appreciably from a constant function in the actual case, and that the divergence is such that the interaction effect on the resonance integral is smaller than would be expected from statistical considerations. This is also confirmed by calculations on the interaction effect. These have been performed using three different methods, namely: considering the actual positions and widths of the resonances, assuming a constant frequency function for the resonance spacing and applying a theory developed by Rowlands and E. A. Fischer, applying a simplified, approximate method for calculations based on the statistical theory. The calculations are made for two temperatures and two values of the plutonium enrichment. It is shown that the average cross sections are considerably larger than the statistical calculations indicate. Author (ESRO)

N69-21275# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

FIELD CURRENT IDENTITY AND VACUUM POLARIZATION EFFECTS OF HADRONS

E. Ettim and P. Picchi 17 Oct. 1968 9 p refs Submitted for Publ.

(LNF-68/60) Avail: CFSTI

A simple method for calculating fairly accurately vacuum polarization corrections of hadrons in e^+-e^- colliding beam reactions is presented. Contributions of resonances to the photon propagator and its modification are considered, and hadronic interference effects are taken into account. P.A.B.

N69-21412# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

EFFECTIVE FIELD APPROXIMATIONS IN CLASSICAL LIQUIDS

Mark Nelkin Dec. 1968 6 p refs

(Rept-68/43) Avail: CFSTI

Three recent approximate theories of coherent scattering of slow neutrons in classical liquids are compared. Close connections are established among them which allow a considerable simplification in the computations needed to compare them with experiment. Author

N69-21427# Laboratoire De Physique Theorique et des Hautes Energies, Orsay (France).

COMPARISON OF INTERATOMIC POTENTIALS FOR ARGON

D. Levesque and J. Vieillard-Baron Jan. 1969 9 p refs

(Rept-69/7) Avail: CFSTI

Extensive studies were made of the thermodynamic properties of the Lennard-Jones fluid. Monte Carlo and molecular dynamics calculations were carried out for systems containing between 100 and 800 particles interacting through a Lennard-Jones 12-6 (LJ 12-6) potential, with periodic boundary conditions. The conclusion of these studies is that the assumption of a LJ 12-6 interatomic potential leads to an equation of state in good agreement with the experimental equation of state of argon, except for temperatures and densities close to the critical point. On the other hand several other potentials were suggested for the interaction between rare gas atoms, and it is known that some of these lead to better fits of the second virial coefficient than the LJ 12-6 potential. The aim of the present work is therefore to investigate whether any of these potentials also tend toward an equation of state in better agreement with the experimental equation of state of argon, particularly in the critical region. Author

N69-21430# Comision Nacional De Energia Atomica, Buenos Aires (Argentina).

DETERMINATION OF THE PARAMETRIC SIGNS OF THE HAMILTONION SPIN [DETERMINACION DE SIGNOS DE LOS PARAMETROS DEL HAMILTONIAN DE SPIN]

Mario E. Foglio 1968 35 p refs In SPANISH

(CNEA-212) Avail: CFSTI

A general study of the assignment of definite signs and values to the parameters of Hamiltonian spin (HS) is presented. A detailed discussion of the problem of axial symmetry using fixed values of HS, and obtaining a second order calculation of perturbations in some selected directions in a magnetic field is included. The general statement is demonstrated by a definite example. It is concluded that this approach does not contradict the possibility of experimental determination of the sign. Transl by F.O.S.

N69-21454# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

HARMONIC ANALYSIS ON THE POINCARE GROUP. PART 1: GENERALIZED MATRIX ELEMENTS

Nghiem Xuan Hai (Ph.D. Thesis—Paris Univ., Orsay) Dec. 1968 30 p refs

(Rept-68/45) Avail: CFSTI

The generalized matrix elements of the unitary representations of the Poincaré group are computed as eigendistributions of a complete commuting set of infinitesimal operators on the group. The unitary representations of the Poincaré group can be reconstructed from these matrix elements in a Hilbert space of square integrable functions over the space of eigenvalues. Some properties of these distributions (which are measures) are given and some characters are computed from the explicit formula for the matrix elements. Author

N69-21462*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

A COMPUTER PROGRAM FOR A LINE BY LINE CALCULATION OF SPECTRA FROM DIATOMIC MOLECULES AND ATOMS ASSUMING A VOIGT LINE PROFILE

Ellis E. Whiting, James O. Arnold, and Gilbert C. Lyle Washington Mar. 1969 116 p refs

(NASA-TN-D-5088) Avail: CFSTI CSCL 20F

A Fortran IV computer program for predicting the spectra resulting from electronic transitions of diatomic molecules and atoms

local thermodynamic equilibrium is described in detail. Included are instructions for preparing the input data, a program listing, and complete flow charts. The program produces a spectrum by accounting for the contribution of each rotational and atomic line considered. The integrated intensity of each line is distributed in the spectrum by an approximate Voigt profile. The program can produce spectra for optically thin gases or for cases where simultaneous emission and absorption occurs. In addition, the program can compute the spectrum resulting from the absorption of incident radiation by a column of cold gas or the high temperature, self-absorbed emission spectrum from a nonisothermal gas. The computed spectrum can be output directly or combined with a slit function and sensitivity calibration to predict the output of a grating spectrograph or a fixed wavelength radiometer. Author

N69-21475# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
KINEMATIC PROPERTIES OF HELICITY AMPLITUDES
J. C. Raynal Jan. 1969 25 p refs
(LPTHE-69/3) Avail: CFSTI

The following problem is solved: given the hypothesis of analyticity about spinor amplitudes, find an equivalent set of properties about helicity amplitudes. The method used is a rather direct one; the sets of properties gotten are now new, except for $\Phi(s,t) = 0$, when the hypothesis of saturation of the analyticity domain of the spinor amplitude is removed. Author

N69-21514# Stanford Univ., Calif. High Energy Physics Lab.
ELECTRON EXCITATION OF PARTICLE-HOLE STATES IN C(12)
T. W. Donnelly, J. D. Walecka, I. Sick, and E. B. Hughes Jun. 1968 12 p refs
(AD-681703; HEPL-567) Avail: Issuing Activity CSCL 20/8

Theoretical and experimental results are given for electron excitation of particle-hole states in Carbon 12. Author (TAB)

N69-21579# Radioptics Inc., Plainview, N. Y.
THE NUMERICAL SOLUTION OF THE ADJOINT TRANSPORT EQUATION FOR GAMMA RAYS BY THE GADJET CODE, PART 2 Final Report
E. R. Friedman, M. H. Kalos (New York Univ., N. Y.), S. Preiser (Polytechnic Inst. of Brooklyn), G. Rabinowitz, and J. G. Beckerley (Columbia Univ., New York) 15 Mar. 1968 115 p refs
(Contract N00228-66-C-1959)
(AD-681715; NRDL-TRC-68-27-Pt-2) Avail: CFSTI CSCL 13/13

A Monte Carlo code, GADJET, is developed for the numerical integration of the adjoint transport equation for gamma radiation. The code is designed to calculate the effectiveness of structures (of arbitrary complexity) in shielding against fallout fields (finite or infinite) and to calculate the relative importance of each fallout region in contributing to the exposure rate in the structure. The mathematical formulation of the code is presented and the code is described in sufficient detail to be equivalent to a users manual. GADJET is written in FORTRAN and has been used in solving civil defense problems. Author (TAB)

N69-21620# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FIT TO S WAVE PION PION PHASE SHIFTS USING CURRENT ALGEBRA
A. Neveu and J. Scherk Jan. 1969 9 p refs
(Rept-69/5) Avail: CFSTI

Recent formulas for parametrization of the S and P waves of pion-pion scattering, which use principles of unitarity and the constraints of current algebra, are modified in order to obtain a satisfactory one parameter fit to the last compilation of S wave phase shifts. The results indicate the existence of a broad resonance at about 700 MeV, and the accuracy of the calculations is in good agreement with experiments. A.C.R.

N69-21646# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A SOLUTION OF THE LEON'S AND BETHE'S MODEL FOR THE DAY-SNOW-SUCHER EFFECT BY DYNAMICAL GROUP METHODS
J.-L. Vermuelen [1968] 17 p refs
(LPTHE-69/6) Avail: CFSTI

In order to explain the discrepancies between the absorption time of π mesons in liquid hydrogen which was calculated by Wightman and by Field et al., Day, Snow and Sucher, they had the idea of a Stark mixing of the orbital states of the mesic atoms (π p). This effect enables an important nuclear capture π p in S states of high principal quantum number n. Indeed the nuclear capture rate is large for the (n,s) states and as soon as some depletion occurs in these states, they are refilled because of the mixing. Leon and Bethe showed that this process shortens the calculated time enough to make it compatible with the experimental values. For other mesons as K mesons, this effect will ensure the absorption in the S state at high n, whereas a large P state absorption might take place if many mesic atoms were reaching the low n states. To calculate quantitatively this mixing process Leon and Bethe use an idealized impact parameter method. Author

N69-21649# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A CALCULATION FOR THE POSITRON ELECTRON YIELDS NEUTRAL PION GAMMA REACTION
E. Cremmer and M. Gourdin Dec. 1968 21 p refs
(REPT-68/44) Avail: CFSTI

This cross section for the annihilation $e^+ + e^- \rightarrow \pi^0 + \gamma$ is calculated in a model. A prediction is made for the $\rho^0 \rightarrow \pi^0 + \gamma$ decay width and a particular interest is devoted to the ρ-meson ω-meson interference. Author

N69-21654# Technische Hochschule Munchen (West Germany).
DETERMINATION OF THE MEAN β ENERGY PER FISSION OF URANIUM 235, URANIUM 233 AND PLUTONIUM 234 BY MEANS OF THE THERMOLUMINESCENSE DOSIMETRY METHOD OF CaF_2 [BESTIMMUNG DER MITTLEREN β ENERGIE PRO SPALTUNG BEI URAN 235, URAN 233 UND PLUTONIUM 239 MITTELS DER THERMOLUMINESZENZDOSIMETRIEMETHODE DES CaF_2]
Helmut Karch (Ph.D. Thesis) 1968 47 p refs In GERMAN
Avail: CFSTI

Calcium fluoride thermoluminescence was used to determine the median beta energy for uranium 233 fission at 6.7 Mev, uranium 235 at 7.54 MeV, and plutonium 239 at 7.6 MeV within ± 4%. Free fission fragment energies of K radiation, fission neutrons, incident and delayed gamma radiation were partly absorbed in calcium fluoride and disregarded. Transl. by G.G.

N69-21746# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A METHOD OF GENERATING MONTE CARLO EVENTS WITH SMALL TRANSVERSE MOMENTA OF SECONDARIES AND THE CORRESPONDING FORTRAN PROGRAM
O. Pene and A. Krzywicki Jan. 1969 49 p refs
(LPTHE-69/10) Avail: CFSTI

The population of events with small transverse momenta of secondaries is enriched, which makes our method particularly

suitable for a study of ultra high energy collisons. A FORTRAN program was written and the corresponding listing is given.
Author

N69-21768# New South Wales Univ., Kensington (Australia). Dept. of Physics.
NUCLEAR THREE-BODY PROBLEM Final Report
John M. Blatt Oct. 1968 3 p
(Grant AF-AFOSR-685-66)
(AD-681726; AFOSR-68-1491) Avail: CFSTI CSCL 20/8

The best available two-body nuclear potential does not fit the three-body data. Three-body nuclear forces are strongly indicated.
Author (TAB)

N69-21779# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANGULAR DEPENDENCE OF THE ENERGY SPECTRA OF SECONDARY IONS AT VARIOUS ANGLES OF EMISSION
U. A. Arifov et al 13 Jun. 1968 18 p refs Transl. into ENGLISH from Akad. Nauk UZSSR. Izv. Seri. Fix.-Mat. Nauk (USSR), v. 11, no. 3, 1966 p 41-47
(AD-681734; FTD-MT-24-129-68) Avail: CFSTI CSCL 20/8

Earlier articles by the authors described the use by them of an electrostatic analyzer to study the angular dependence of the energy spectra of secondary ions during the bombardment of metals by positive ions. On the basis of the resulting data the authors concluded that during the bombardment of metals by ions in an energy range of 1-3 kev scattering is explained by paired collisions, single and multiple. The earlier articles described the results of the energy analysis of the secondary ions emitted at a certain angle 50 deg in relation to an angle of incidence of 10-80 deg. As a result of the design of the instrument it was possible, by changing the target position vis-a-vis the analyzer, to study the dependence of the energy spectra of the secondary ions on the angle of incidence at various emission angle values. The present article gives the results of these investigations, in particular, oscillograms showing the energy distribution and the angular dependence of the energy spectra at various angles of emission for secondary ions when a Mo target heated to 1800 K is bombarded by positive potassium or cesium ions with energy E0 = 1000 ev. The authors discuss some of the results and conclude that they can be explained from the viewpoint of paired collisions of the bombarding ions with a system of free atoms.
TAB

N69-21793# Paris Univ. Orsay (France). Laboratoire de l'Accelerateur Lineaire.
COMPARISON OF ORSAY RESULTS ON VECTOR MESONS WITH THE VECTOR MESON DOMINANCE MODEL PREDICTIONS
J. E. Augustin, D. Benaksas, J. Buon, V. Gracco, J. Haissinski et al Nov. 1968 14 p refs
(LAL-1204; PB-180778) Avail: CFSTI CSCL 20H

Results of the three Orsay experiments are analyzed in the vector meson dominance hypothesis. The coupling constants of the neutral rho, neutral omega and neutral phi mesons to the photons are determined, and the mixing angle theta sub y and theta sub n of the neutral omega and neutral phi mesons are calculated. Our values are compared to various theoretical preditions.
Author (USGRDR)

N69-21798# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur.
NEUTRAL OMEGA MESON PRODUCTION BY ELECTRON-POSITRON ANNIHILATION
J. E. Augustin, D. Benaksas, J. Buon, V. Gracco, J. Haissinski et al Nov. 1968 12 p refs
(LAL-1202; PB-180776) Avail: CFSTI CSCL 20H

The reaction, electron positron annihilation gives a neutral omega meson, has been measured by detecting the charged pions of the three pion decay mode of the neutral omega meson. A partial decay width of the neutral omega meson in electron positron annihilation is deduced from this result.
Author (USGRDR)

N69-21802# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur.
STUDY OF ELECTRON-POSITRON ANNIHILATION INTO POSITIVE PION NEGATIVE PION ON THE NEUTRAL RHO MESON RESONANCE
J. E. Augustin, J. C. Bizot, J. Buon, D. Lalanne, J. Haissinski et al Nov. 1968 15 p refs
(LAL-1203; PB-180777) Avail: CFSTI CSCL 20H

The electromagnetic form factor of the pion has been determined in the neutral rho meson resonance region by measuring the absolute cross section of the reaction position + electron gives pion (+) + pion (-) with the Orsay storage ring. More than 800 pion pairs have been detected. The excitation curve has been fitted with a Breit-Wigner formula.
Author (USGRDR)

N69-21809# Technische Hochschule Munchen (West Germany).
CHARGE DISTRIBUTION OF EXCITED LEVELS OF u-g NUCLEI [ZUR LADUNGSVERTEILUNG ANGEREGTER NIVEAUS VON u-g-KERNEN]
Joseph Speth (Ph.D. Thesis) 1968 85 p refs In GERMAN
Avail: CFSTI

The Migdal-Larkin theory for finite systems is derived from an exact theory, taking pair correlations into account. It is demonstrated that omission of the pair correlations in the normal mass operator Σ^{11} is the only approximation that fits into the entire Migdal-Larkin theory. For the equation of the density change in an N-particle system caused by the addition of another particle in the absence of pair correlations, it is shown that the equation cited by Migdal is correct only in the approximation and that the renormalization factor of the added occupied level n lo be be stated as equaling 1. In case of systems with pair correlations and given exact derivations, the results indicate that contrary to the equations used heretofore in applicable work, the inhomogeneous term has the form of the BCS boundary case. This is analogous to systems without pair correlations in which case the results will be shell model values.
Transl. by K.W.

N69-21840# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
STUDY OF THE PHI MESON PRODUCTION WITH THE ORSAY ELECTRON-POSITRON COLLIDING BEAMS
J. E. Augustin, J. C. Bizot, J. Buon, B. Delcourt, J. Haissinski et al Oct. 1968 15 p refs
(PB-180775 LAL-1199) Avail: CFSTI CSCL 20H

Phi meson production by positron-electron annihilation was studied with the Orsay colliding ring. The K meson and pi meson decay modes of the phi were detected. Simultaneously, the detection system measured the large angle Bhabha positron-electron scattering reaction, this reaction being used as one of the two measures of luminosity performed in this experiment.
Author (USGRDR)

N69-21845# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PHOTOPRODUCTION OF PION BY POLARIZED GAMMA RAYS

G. Barbiellini, G. Bologna, G. Capon, J. De Wire, G. De Zorzi et al 8 Jan. 1969 25 p refs
(LNF-69/3) Avail: CFSTI

The photoproduction of pions has been extensively investigated both theoretically and experimentally. In the present experiment the asymmetry of the cross sections from polarized photons, for pion photoproduction on hydrogen, has been measured using the coherent bremsstrahlung beam from a diamond. This beam is a Frascati electron synchrotron facility. The asymmetry has been measured at a proton angle of 90° in the center-of-mass system for photon energies ranging from 230 to 380 MeV. Author

N69-21850# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PRACTICAL COMPUTATIONS ON SOME SIMPLE THREE-BODY SYSTEMS
G. Mennessier, J.-Y. Pasquier, and R. Pasquier (Inst. de Phys. Nucl., Orsay) Jan. 1969 64 p refs
(PTHE-69/8) Avail: CFSTI

Three-body resonances in the $\pi\ \pi\ \pi$, K Anti-K π and K $\pi\ \pi$ systems are studied on the basis of a relativistic version of the Faddeev equations. The input two-body amplitudes are taken separably with respect to the initial and final off-shell momenta. A first discussion concerns the simplest $\pi\ \pi\ \pi$ and K Anti-K π systems in which only the ρ (765 MeV) or the K^* (890 MeV) is taken into account. The main purpose is to disclose those aspects of the analysis which are relatively independent of the unknown parameters of the off-shell form factors. Three main types of form factors have been considered. According to the type, rather different results are obtained for the magnitude and the detailed properties of the three-body effects. In particular, essentially two possibilities are offered for obtaining sufficiently distinguishable three-body resonances. An interesting feature is that the $T^G(T^P)$ states in which these resonances are observed appear to be the same in the two cases. A reasonable agreement with experiment is found for the three-pion system. Author

N69-21871# Technische Hochschule Munchen (West Germany)
DECAY TIME OF NEUTRON PULSES IN NON-1/v TOXIC D SUB 2 O [ZEITLICHER ZERFALL VON NEUTRONENPULSEN IN NICHT-1/v-VERGIFTETEM D SUB 2 O]
Theo Doellgast (Ph.D. Thesis) 1968 72 p refs In GERMAN
Avail: CFSTI

Deuterium decay modes were determined by Fourier analysis as functions of samarium and cadmium absorption of axial neutron flow. Results were compared with absorption values for a high purity 1/v boron material; geometric buckling measurements on all three absorbers stayed within predicted boundaries. Transl. by G.G.

N69-21893# National Bureau of Standards, Washington, D.C. Metrology Div.
SPECTRAL EMISSION PROPERTIES OF NBS STANDARD PHOSPHOR SAMPLES UNDER PHOTO-EXCITATION
Carl F. Shelton (IBM) Mar. 1968 32 p refs
(NBS-TN-417) Avail: SOD $0.25

The photo-excitation spectral emission properties of 10 and 14 NBS standard phosphor samples have been determined. Pressed tablets of the phosphors were excited by radiation from a mercury arc lamp, passing through a narrow band-pass filter to obtain either 2537Å or 3650Å excitation. The measurement system is described, correction of the data is discussed, and the spectral emission data are presented. Relative quantum efficiencies were calculated. The results are compared with measurements reported by two other laboratories. Author

N69-21895# National Bureau of Standards, Washington, D.C. Institute for Basic Standards.
BIBLIOGRAPHY ON THE ANALYSIS OF OPTICAL ATOMIC SPECTRA, SECTION 1: HYDROGEN THROUGH VANADIUM
Charlotte E. Moore Sep. 1968 90 p refs
(NBS-SP-306) Avail: SOD $1.00

The bibliography contains reference lists for the elements 1 H through 23 V. The spectra of a given element are listed in order of increasing stage of ionization. Listings are included for spectra of the 23 elements. The original papers have been examined for nearly all of the quoted references. A selected list of general literature references is also included. Author

N69-21898# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
SOME REMARKS ON Q.E.D. BREAKING
A. F. Grillo 3 Jan. 1969 18 p refs
(NLF-69/1) Avail: CFSTI

Some considerations are given to the hypothesis of a breakdown of quantum electrodynamics. The possibility that the electron does not behave like a point particle is examined; a magnetic as well as an electric form factor is attributed to the electron. This is analogous to the structure of protons which is expressed by the Rosenbluth formula for ep → ep scattering. The reaction of the one photon channel (e^+e^- → n hadrons) is considered and their cross sections examined on the grounds of the symmetry properties of e.m. interactions. It was concluded that the electro structure can be trusted by measurements of the angular distribution of the final particles. The consequences of modifying the photon propagator are examined. Author

N69-21899# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
TOTAL ETA MESONS-NUCLEON CROSS SECTION BY PHOTOPRODUCTION OF ETA MESONS IN COMPLEX NUCLEI
C. Bacci, (1st Nazl. di Fis. Nucl., Sez. di Roma, Rome), R. Baldini-Celio, V. N. Eponeshnikov, C. Mencuccini, A. Reale et al 23 Jan. 1969 9 p refs
(LNF-69/4) Avail: CFSTI

The results are reported of an experiment performed with the 1.1 GeV electronsynchrotron on the photo production of ηmesons in complex nuclei. The reaction studied was: γ + nucleus → η + residual nucleus, for nuclei of different atomic weight by measuring the differential cross section for this process. The measurements were made at a total energy in the center of mass $E^* = (1600 \pm 35)$ MeV and at an angle of the outgoing η around 90° in the center of mass system of the γ-ray and target nucleon. Under these conditions the momentum transfer in the reaction is sufficiently high to virtually exclude coherent η production. Due to the interaction of the produced η with nucleons inside the nucleus, the dependence of the differential cross section on atomic weight is strictly related to the total cross section for the process: η + nucleon → all channels. Author

N69-21949# Technische Hochschule Munchen (West Germany).
MICROSCOPIC THEORY OF THE COLLECTIVE MOVEMENTS OF STRONGLY DEFORMED g-g-NUCLEI [MIKROSKOPISCHE THEORIE DER KOLLEKTIVBEWEGUNG STARK DEFORMIERTER g-g-KERNE]
Gottfried Holzwarth (Ph.D. Thesis) 1968 82 p refs In GERMAN
Avail: CFSTI

A method is proposed for the microscopic description of the collective excitation conditions of strongly deformed nuclei. In

this method, the diagonalization of the highly dimensional non-hermetian matrix is avoided. Rather than explaining the dynamic structure of the system in terms of the elementary components, i.e. in terms of the quasi-principles, an attempt is made to introduce intermediate units composed of the elementary components, thereby facilitating the construction of the total system. The vibrational structure thus was accomplished by expressing the energies and the interactions of the corresponding bosons in terms of the microscopic hamiltonian operator. In line with this, a pair of canonic generator coordinates was introduced for each type of oscillation; the form of these pairs represents a first approximation for the structure of the enforced oscillations. The cranking approximation for the correlated wave functions is described and used to replace the projection with the real values of the rotational impulse. The entire formalism is then applied to the rotation-vibration spectrum of Mg 24. Transl. by K.W.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-20716# Liege Univ. (Belgium). Inst. d'Astrophysique.
LINEAR STARK EFFECT IN HYDROGEN-TYPE IONS [L'EFFET STARK LINEAIRE POUR LES IONS HYDROGENOIDES]
S. Volonte 1968 86 p refs In FRENCH
Avail: CFSTI

The classical theories of spectral line broadening are reviewed and the ranges of applicability of the impact and quasi-stationary theories are discussed. The more modern pressure effect theory is derived and applied to the spectrum of atomic hydrogen. Such investigations are of special interest in the study of astrophysical plasmas constituting stellar atmospheres. Several theories developed elsewhere are discussed and compared as regards their physical justification. ESRO

N69-20774*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
NUMERICAL STUDY OF WEAKLY UNSTABLE ELECTRON PLASMA OSCILLATIONS
Thomas P. Armstrong (Kansas Univ.) and David Montgomery Feb. 1969 18 p refs
(GRANT NGR-16-001-043)
(NASA-CR-100420; U-of-Iowa-69-10) Avail: CFSTI CSCL 20I

The initial value problem for an unstable electron plasma has been solved by numerically integrating the Vlasov equation in one dimension. The situation chosen is the familiar "bump-on-the-tail" situation of quasi-linear theory. The solution is followed well beyond the point at which the electrostatic field energy has reached its maximum value. The electric field spectrum is eventually dominated by the single most linearly unstable wave number, which lies in the middle of the allowed range of wave numbers; it undergoes what appear to be the beginnings of gentle long-period oscillations characteristic of trapped-particle periodicities. It is argued that differences from quasi-linear predictions may be explained in terms of the level of initial excitations, or "noise", from which the instability is assumed to proceed. Author

N69-20806 Michigan Univ., Ann Arbor.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF MAGNETICALLY BALANCED ARCS
Robert Laurie Harvey (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-13323

An experimental and theoretical investigation of electric arcs balanced magnetically in transverse air flows was conducted to determine the fluid dynamic structure of the stable column interacting with the free stream. The experimental work was in a Mach number range of 2.5 to 3.5, with stagnation pressures of 10 to 29 in. Hg. Arc currents were from 130 to 700 amperes with the arc balanced by an external magnetic field up to 3000 gauss in strength. A mathematical model for the internal flow based upon the experimental work was formulated and solved numerically. The resulting flow pattern had a doublet-like flow structure with the maximum temperature peak shifted in the Lorentz direction. It was concluded that the boundary temperature and induced electric field are important factors affecting the internal flow, while compressibility is less significant. Dissert. Abstr.

N69-20875*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROTHERMAL INSTABILITIES IN THE ENTRANCE REGION OF AN MHD GENERATOR
J. Martin Smith Washington Mar. 1969 23 p refs
(NASA-TM-X-1761) Avail: CFSTI CSCL 20I

In the entrance region of a nonequilibrium MHD generator one finds an abrupt rise in electron temperature followed by a four- or five-decade increase in electron density. We consider the stability of this region of abrupt electron density rise. A solution is found in the limit that the ambipolar diffusion field is small compared to the transverse applied electric field. The solution is found to be stable in the limit of zero magnetic field but to be unstable in the presence of a magnetic field. Author

N69-20901 Stanford Univ., Calif.
SPECTROSCOPIC INVESTIGATION OF ELECTRON TEMPERATURE DISTRIBUTION IN A NON-EQUILIBRIUM PARTIALLY IONIZED FLOWING PLASMA
Glenn Fredrick Hohnstreiter (Ph.D. Thesis) 1968 225 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-11309

Measurements were made in an arc-heated argon plasma seeded with vaporized NaK, for plasma temperatures ranging from 1300°K to 2100°K and electron number densities ranging from 10^{11} to 10^{13} cm^{-3}. The measurements were obtained primarily with an interference-filter photographic method which was developed for this investigation and applied to the Na 3S–3P and Na 3P–3D atomic line radiation. It was found that all of the observed measurements fit into a total of eight discharge classifications which describe the pre-breakdown and postbreakdown gaseous-discharge characteristics. The correlation between the Na 5890 Å population temperature and the electron temperature was analyzed theoretically. The equation of radiative transfer was solved numerically to determine the effects of self-absorption on the relative intensity emitted by the plasma. Dissert. Abstr.

N69-20956 Michigan Univ., Ann Arbor.
REDUCTION OF ALUMINUM OXIDE TO ALUMINUM IN RADIO FREQUENCY GENERATED PLASMAS
Roger Keranen Reims (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-13384

The reduction was effected by feeding alumina into Ar, Ar–H_2, Ar–CO and Ar–CH_4 plasmas. The plasmas were contained in a water-cooled quartz reactor and flowed downward. The products were collected on the reactor wall and on water-cooled quench probes placed directly in the plasma. The conversion of Al_2O_3 to Al was based on the amount of aluminum and aluminum oxide

actually collected since complete recovery of the products was not attempted. In argon plasmas, the conversion was investigated as a function of Al_2O_3 particle size, Al_2O_3 mass flow rate and power input to the plasma. The effect of quenching the reaction mixture in a reducing atmosphere was determined by introducing H_2, CO and CH_4 into the lower section of the plasma countercurrent to the plasma flow. The products were positively identified by X-ray diffraction and wet chemical techniques. In addition, the gaseous plasma reaction zones were examined spectroscopically to give some insight as to the nature of the gas–solid reaction. Dissert. Abstr.

N69-20932# Commissariat à l'Energie Atomique, Limeil (France). Service de Mathématiques Appliquées.
USE OF A MONTE–CARLO METHOD FOR STUDYING THE STATISTICAL DISTRIBUTION OF ELECTRIC FIELDS AROUND AN ION IN A ONE–COMPONENT PLASMA [ETUDE, PAR UNE METHODE DE MONTE–CARLO DE LA REPARTITION DES CHAMPS ELECTRIQUES AU NIVEAU D'UN ION, DANS UN PLASMA A UNE COMPOSANTE]
Daniel Rossignol-Guzzi (Ph.D. Thesis—Paris Univ.) Nov. 1968 105 p refs In FRENCH; ENGLISH summary
(CEA-R-3615) Avail: CFSTI

A Monte–Carlo simulation has been made of the equilibrium configurations taken by a plasma of equally charged point ions, immersed in a uniform neutralizing background of electrons. The statistical distribution of the electric field acting on one ion, needed to obtain the Stark effect, was specially obtained. Comparisons, for dense plasmas, are made with the work of Holtzmark, Mayer, Broyles. Author (ESRO)

N69-20997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CAUSES OF MAGNETIC-FIELD NONUNIFORMITY AND ITS EFFECT ON STABILITY OF THETA-PINCH PLASMA
Joseph Norwood, Jr. Washington Mar. 1969 65 p refs
(NASA-TR-R-303) Avail: CFSTI CSCL 20I

Sources of the field nonuniformity are delineated and discussed. These include the collector-plate geometry, the nonlinear effect of the plasma, end effects in the coil, discontinuity in gap spacing as the current flows into the coil, and effects of the alteration in axial current distribution due to skin effect. Next the various methods for stabilizing the plasma by eliminating field gradients are described, and a new method involving the use of a flux concentrator is proposed. The advantages of this method are compared with advantages of other techniques that have been used. Also, results of quantitative measurements of the field uniformity in an exact 1/2-scale model of the Langley theta pinch are presented. These results include flux concentrator and collector-plate-extension effects as well as the effect of the volume of the collector-plate structure which excludes high frequency flux due to skin effect. Finally, experiments which suggest that full scale theta pinches without extensions are capable of being stabilized by flux-concentrator techniques are described. Author

N69-21087 New Mexico Univ., Albuquerque.
NUMERICAL STUDIES OF AN INVERSE PINCH DEVICE
John Richard Freeman (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-11656

The inverse pinch configuration is examined as a possible means of producing stable, repeatable shock waves in a plasma for laboratory investigation. The simple geometry permits investigation of cases with or without an initial transverse magnetic field in an un-ionized or pre-ionized medium. The solution presented here consists of a finite difference, Lagrangian coordinate system solution for a one-fluid hydromagnetic model. The hydromagnetic model chosen includes the effects of a variable degree of ionization, assuming a hydrogenic plasma. Complete flexibility for the initial state of the gas is retained, along with the capability of using either a magnetic field boundary condition or simultaneously solving the external circuit equation for the field-time history. An electrical conductivitity dependent on both the temperature and magnetic field is used. Extension for the linear and theta pinch geometries is discussed. Dissert. Abstr.

N69-21092*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A UNIFIED QUASILINEAR THEORY OF WEAKLY TURBULENT PLASMAS
C.-S. Wu 1 Aug. 1968 21 p refs
(Contract NAS7-100)
(NASA-CR-100429; JPL-TM-33-397) Avail: CFSTI CSCL 20I

A quasilinear theory is formulated which includes the microscopic fluctuation fields as well as the coherent waves. The study emphasizes those cases in which the propagating mode of the fluctuation field gives rise to a dominant contribution to the particle correlation. In other words, in these cases the spontaneous Cerenkov emission of plasmons can play a more important role than the two-particle collision process. The instability which is responsible for the turbulence can be of either electrostatic or electromagnetic, or of mixed nature. The effect of an external magnetic field is also considered in the present theory. The final result is valid for an arbitrary ratio of the energy density of the coherent wave to that of the fluctuation field, although the condition of weak turbulence is imposed throughout the analysis. Author

N69-21100# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
GENERAL RELATIONS FOR THE EM WAVE SCATTERING IN THE BORN APPROXIMATION FROM A SMALL TURBULENT PLASMA
T. E. Luzzi Feb. 1969 40 p refs Submitted for publication
(RE-361) Avail: Issuing Activity

General relations are developed for the classical scattering of plane electromagnetic waves in the first Born approximation from the turbulent fluctuations in the electron density of a weakly ionized, finite volume, arbitrarily shaped plasma. By finite volume, it is meant that the correlation length of the turbulence compared to the dimensions of the plasma can be arbitrary. Previous work had applied only to the case of small correlation lengths. It is assumed that the transmitter for the incident and the receiver for the scattered radiation are in the far field of the scattering plasma. Scattering relations for a one dimensional plasma are presented to make clear the differences between the large and small correlation length cases. The general relations are shown to reduce to the Booker–Gordon relations when the correlation length is small. Scattering from a parallelepiped plasma, showing large differences from the small correlation length relations, is presented. Author

N69-21124*# United Aircraft Corp., East Hartford, Conn.
THEORETICAL INVESTIGATION OF THE COMPOSITION AND LINE EMISSION CHARACTERISTICS OF ARGON–TUNGSTEN AND ARGON–URANIUM PLASMAS
N. L. Krascella Washington NASA Mar. 1969 76 p refs
(Contract NASw-847)
(NASA-CR-1313; G-910092-10) Avail: CFSTI CSCL 20I

A theoretical investigation was conducted to determine the composition and integrated line emission characteristics of various ionization species of tungsten, uranium, and argon. The study was made to facilitate radiant heat transfer analysis in the seeded propellant and nuclear fuel regions of gaseous-core nuclear rocket engines and to provide a basis of comparison for a concurrent experimental program designed to examine line emission

characteristics of gaseous tungsten and uranium over a wide spectral range. Estimates were made of the composition as a function of temperature for mixtures of Ar with tungsten hexafluoride and uranium hexafluoride using an existing UARL machine composition program to ascertain the decomposition products of WF_6 and UF_6. Integrated line intensities summed over wavelength intervals of 100 Å were calculated in the spectral region between wavelengths of 1700 Å and 10,000 Å. W-to-Ar or U-to-Ar mass ratios of 1.0×10^{-3}, 1.0×10^{-5}, and 1.0×10^{-7} were considered at temperatures of 5000, 7000, and 9000 deg K. Author

N69-21136# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ENHANCED PARTICLE LOSSES DUE TO ELECTRON CYCLOTRON WAVE INSTABILITY IN MAGNETIC MIRRORS
H. Momota and Y. Terashima Dec. 1968 30 p refs
(IPPJ-79) Avail: CFSTI

The electron cyclotron wave instability of non-uniform plasmas in magnetic mirrors was investigated. The most unstable mode of the instability is studied under an appropriate boundary condition. The non-linear development of the instability is discussed in terms of the diffusion equation in velocity space for the resonant particles. The particle loss along the magnetic lines of force was found to be appreciable. Some numerical examples are presented. Author

N69-21199# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SPATIAL ION-WAVE ECHOES
H. Ikezi, N. Takahashi, and K. Nishikawa Nov. 1968 49 p refs
(IPPJ-75) Avail: CFSTI

Theory and experiments of spatial ion-wave echoes are reported. Emphasis is placed on the investigation of the line-shape of the echo and on the collisional effects. In the collisionless approximation, the calculated line-shape of the second-order echo is found to be a universal function the distance from the expected position of the echo divided by the Landau damping length of the ion-wave constituting the echo. This feature is demonstrated experimentally for the case of a small separation between the two exciters. Higher-order echoes predicted by Gould are observed up to the fourth order with respect to the external fields at the predicted positions with the predicted dependence of their amplitude on the amplitude of the primary waves. In addition to these, new types of higher-order echoes (the secondary echoes) which result from the electric fields of other echoes are predicted and observed (on the third and fourth orders). Author

N69-21263# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
ON THE DECAY OF A MAGNETIZED PLASMA
B. Lehnert, J. Bergstrom, and S. Holmberg Nov. 1968 33 p refs Supported jointly by the Swed. Atomic Res. Council, the Res. Inst. of Natl. Defence and the Roy. Inst. of Technol.
(REPT-68-20) Avail: CFSTI

A static fully ionized and magnetized plasma is suddenly given a small pulse of angular momentum. After a short time the momentum is recovered by means of an electric short-circuit and appears as a reversed current pulse. The latter can only be detected as long as at least parts of the plasma are in a fully ionized state. From such measurements the following conclusions can be drawn about the decay of the plasma: the equivalent electric capacity which corresponds to the recovered momentum decays in about 0.5 milliseconds at plasma densities of the order of $10^{21} m^3$; an important contribution to this decay is due to penetration of neutral gas into the plasma from surrounding regions. The measured decay time is consistent with theory and shows that the rate of penetration can be delayed considerably in a fully ionized plasma, provided that its density is high enough; in the present experiments the process of penetration proceeds much slower than the heat decay. It is therefore difficult to draw conclusions about the heat balance from studies of the plasma decay. It is still possible to reveal a small delay in the penetration rate when the heat losses along the magnetic field are reduced by an order of magnitude; volume recombination contributes to the decay of the plasma, but in the present experiments this contribution appears to be less than that from the penetration of neutrals. Author (ESRO)

N69-21275# Avco-Everett Research Lab., Everett, Mass.
INSTABILITY OF HALL MHD GENERATORS TO MAGNETO-ACOUSTIC WAVES
Frank J. Fishman Feb. 1969 42 p refs
(RR-323) Avail: Issuing Activity

It is known that magnetoacoustic waves propagating anti-parallel to a steady electric current in a dense, weakly ionized gas may exhibit substantial growth. The stability of a Hall MHD generator with supersonic flow to disturbances of this type is assessed. A proper boundary value problem is solved, with full consideration of the load circuit, which may serve as a feedback path for wave energy. It is shown that this feedback may lead to instabilities even under conditions such that the wave growth (as evaluated by earlier investigations) is slow. Disturbances with a period comparable to the flow time (channel length/fluid velocity) are the principal contributors to the instability; the spatial variation of these disturbances are far from sinusoidal. The control of machine instabilities by electrical filters in the external (load) circuit is described. Author

N69-21340# Commissariat a l'Energie Atomique, Limeil (France). Service de Physique Générale.
CONFINEMENT OF A NON-CYLINDRICAL DISCHARGE BY A CUSP GEOMETRY [CONFINEMENT D'UNE DECHARGE LINEAIRE NON-CYLINDRIQUE PAR UNE GEOMETRIE MAGNETIQUE CUSPIDEE]
Jean-Paul H. Watteau (Ph.D. Thesis—Paris Univ., 4 Mar. 1968) Nov 1968 110 p refs In FRENCH; ENGLISH summary
(CEA-R-3523) Avail: CFSTI

The plasma of a noncylindrical z discharge is accumulated in the center of a cusp geometry and then captured and confined by the rising cusp magnetic field. The cusp geometry is produced by two identical coaxial coils the currents of which are equal but in opposite directions. Stability and confinement properties of this zero minimum B geometry are recalled; in particular it is shown that the magnetic well depth of the configuration without plasma is maximum for an optimum coil distance. Two modes of confinement are observed experimentally: a collisional mode for which the plasma confinement is limited to 10 μsec (temperature 5 eV, density $7 \times 10^{16} cm^{-3}$) as a result of the gradual interpenetration of the plasma and of the magnetic field; a collisionless mode (temperature 40 eV) where the radial leak thickness is of the order of the ion cyclotron radius. Plasma accumulation occurs even without confinement and is due to the non-cylindrical shape of the discharge chamber. The two-dimensional snow-plough model gives good account of the discharge dynamics. A comparison is made with plasma focus experiments: in particular experimental conditions (deuterium, pressure 1 torr, energy 3 kJ, current 100 kA) a 10^7 neutron yield is detected which appears to be connected with the unstable behaviour of the discharge. Author (ESRO)

N69-21623# Yeshiva Univ., New York. Belfer Graduate School of Science.
RESEARCH DIRECTED TOWARD UNDERSTANDING BEHAVIOR AND DETECTION OF PLASMAS IN MAGNETIC FIELD Final Report, 1 Nov. 1967–31 Oct. 1968
David Finkelstein 30 Nov. 1968 18 p refs
(Contract F19628-68-C-0161)
(AD-682306; AFCRL-68-0656) Avail: CFSTI CSCL 20/9

A summary is given of a study of the physics of high voltage, large current plasma discharges. Studied were discharges with currents large enough for magnetic field effects to be prominent (> 100,000 A) and voltages large enough for relativistic effects to be appreciable (> 1,000,000 V). Towards this end, the emphasis during this period was placed on reliable diagnostic techniques. 1MV electric field probes, 1MA current probes, and a double exposure holographic optical probing system were developed. The elements of the discharge apparatus are reviewed and the diagnostic methods are described. In addition a study of the structure of ball-lightning was concluded and the pertinent results are presented.
Author (TAB)

N69-21632# California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
FACTORS AFFECTING THE GROWTH OF BOUNDARY LAYERS IN PLASMA ACCELERATORS Final Report
Frank E. Marble Dec. 1968 18 p refs
(Contract AF 49(638)-1285)
(AD-681519; AFOSR-69-0177TR) Avail: CFSTI CSCL 20/9

The aim of the research was to investigate some aspects of the interaction between a seeded plasma and the electrode or non-electrode walls of plasma accelerators or generators. The problem was complicated over that of conventional plasma flow because a seeded gas was involved, and consequently the physics of surface - gas interaction required some investigation. The program included experimental investigations of the properties of seeded plasmas, stability of the plasma flow, ionization rates and ionization mechanism, as well as boundary-layer type analysis. The work was divided into three different parts: (1) boundary layer analysis and gas phase and surface phenomena affecting the electrical properties of potassium-seeded argon, (2) ionization rates and ionization mechanisms in the noble gases, (3) stability of the plasma flow under the action of electrical and magnetic fields. Author (TAB)

N69-21705# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF HIGH SPEED MEASUREMENTS IN GAS DYNAMICS AND PLASMA PHYSICS
Yu. E. Nesterikhin et al Feb. 1968 186 p refs Transl. into ENGLISH of the Monograph "Metody Skorostnykh Izmerenii v Gazodinamike i Fiziki Plazmy" Moscow, Nauka, 1967 p 1-172
(AD-682067; FTD-MT-24-19-68) Avail: CFSTI CSCL 20/9

Described are the most promising methods of low-inertia measurements of speed, density, temperature, pressure, concentrations, intensity of magnetic and electrical fields in shock tubes and plasma injectors, in devices for rapid compression of ionized gas by the magnetic field and in other pulse gas dynamic and plasma apparatuses. A short analysis is given of the different methods of obtaining shock waves, high-speed flow of gas and high-temperature plasma. Examined in detail are methods of observations of high-speed gas flows and different methods of quantitative measurements of the density of neutral particles and electrons. The application of spectral methods for pulse measurements of temperature and concentrations and also the use of methods of temporal mass spectroscopy in pulse plasma apparatuses are shown.
Author (TAB)

N69-21761# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A DESCRIPTION OF LASER-PRODUCED PLASMAS. 1: ELECTRON AND ION TEMPERATURES
Frank J. Allen Dec. 1968 38 p refs
(AD-681904; BRL-R-1428) Avail: CFSTI CSCL 20/9

A method is derived for obtaining ion temperature in laser-produced plasmas from experimental results. Ion temperatures are then obtained from published data. Various determinations of electron temperatures in similar plasmas are considered. It is found that for incident laser beam intensities on solid targets in the range of 10 to the 10th or 11th power watts per square centimeter, electron and ion temperature lie between 10 and 20 electron volts. Means of improving experimental results, on which the ion temperature determinations are based, are also discussed.
Author (TAB)

N69-21789# Naval Research Lab., Washington, D. C.
DETERMINATION OF ELECTRON TEMPERATURES BETWEEN eV AND 100 keV FROM X-RAY CONTINUUM RADIATION IN PLASMAS Final Report
R. C. Elton Dec. 1968 69 p refs
(AD-681728; NRL-6738) Avail: CFSTI CSCL 20/9

Previous calculations of the total integrated bremsstrahlung radiation passing through absorbing foils of beryllium, aluminum, and nickel (as well as aluminum and nickel in combination with carbon (polyethylene)) are included and extended to cover temperatures equivalent to an energy range from 50 eV to 100 keV and to include gold. Such information is necessary in obtaining values for the electron temperature in a plasma from measurements of the soft x-ray continuum emission. The spectral distribution of the transmitted continuum radiation is presented over the entire temperature range, for use in determining the most suitable spectral region.
Author (TAB)

N69-21794# California Univ., Berkeley. Div. of Aeronautical Sciences.
THE RESPONSE OF FREE MOLECULE CYLINDRICAL LANGMUIR PROBES IN A TURBULENT PLASMA
Edward Peterson (Ph.D. Thesis) Nov. 1968 135 p refs
(Grant AF-AFOSR-538-68)
(AD-681838; AS-68-10) Avail: CFSTI CSCL 20/9

A theoretical and experimental investigation of the response of a free molecule Langmuir probe in a turbulent plasma is made. The effect of arbitrary fluctuations in charged particle density, electron temperature, plasma potential, and ion temperature are considered. The results are applicable for (a) frequencies somewhat less than the ion plasma frequency, (b) moderate ratios of probe radius to Debye lenght, (c) moderate ratios of applied potential to electron temperature and (d) ratios of ion to electron temperatures less than one. The steady state characteristic is obtained by forming an empirical fit to a numerical analysis describing the collisionless probe current collection. Relations are then derived showing the effect of fluctuations on the average properties, and the connection between the r.m.s. probe current and the various correlations. Electron temperature, charged particle density, floating potential, single probe saturation ion and electron current and double-probe current measurements are studied in detail. It is found that the sensitivity of the probe to the various fluctuating quantities is a function of the ratios of probe radius to Debye length, applied potential to electron temperature, and ion to electron temperature. Subsequently it is shown that many of the correlations and average properties may be determined. Experiments are performed in an unsteady highly expanded low density flowing argon plasma. Both the average and r.m.s. currents are monitored using cylindrical Langmuir probes.
Author (TAB)

N69-21797# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
RESISTIVE INSTABILITIES OF A VISCOUS MAGNETOFLUID
Peter Unteregger 25 Nov. 1968 19 p refs
(Contract F61052-67-C-0014)
(AD-681513; AFOSR-69-0121TR; SR-60) Avail: CFSTI CSCL 20/9

The simultaneous influence of finite electrical conductivity and viscosity in the presence of a possibly varying gravitational field on the oscillatory modes of a plasma is examined, using the linearized non-ideal magneto-hydrodynamic equations. It is shown, that hydromagnetic modes of an inhomogeneous, incompressible plasma are strongly influenced by the behaviour of the Alfven frequency. Furthermore, when the magnetic field of the equilibrium configuration is perpendicular to the wave vector of the perturbation, the magnetic field has no influence on all possible oscillatory-mode eigenfunctions. Finally, new modes due to the simultaneous introduction of finite electrical conductivity and viscosity are found. In the limit of zero viscosity or infinite electrical conductivity the results correspond to that previously obtained. Author (TAB)

N69-21801# Illinois Univ., Urbana. Coordinated Science Lab.
EFFECT OF HOLE DIAMETER ELECTRODE WIDTH AND GLASS THICKNESS ON PROPERTIES OF THE PLASMA DISPLAY CELL
Walter F. Goede Jul. 1968 58 p refs
(Contract DAAB07-67-C-0199)
(AD-681704; R-385) Avail: CFSTI CSCL 20/9

In the design of Plasma Display Cells it is useful to know how the properties of the panel are affected by the physical geometry of the panel. It was shown that the properties of the panel are directly related to its physical dimensions, and can be enhanced by proper design. With large holes and sufficiently high voltages it is also possible to create more than one discharge in any half cycle. This phenomenon is also discussed. Author (TAB)

N69-21817# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCELERATION OF PARTICLES WITH INTERACTION BETWEEN HIGH-FREQUENCY FIELDS AND A PLASMA
I. S. Danilkin et al Apr. 1968 18 p refs Transl. into ENGLISH from Tr. Fiz. Inst. Akad. Nauk SSSR (Moscow), v. 32, 1966 p 165–172
(AD-681636; FTD-MT-24-52-68) Avail: CFSTI CSCL 20/9

The article analyzes several mechanisms for the acceleration of the individual particles of a plasma acted upon by a high frequency field. It considers the conditions under which data can be taken on the mechanism of acceleration, and offers an evaluation of the mean values of the energy which can be collected by the ions and the electrons. The article starts with a mathematical development of the problem of acceleration brought about by waves with a fixed phase in a weak high frequency field, and then goes on to a consideration of the same problem with waves of random phase in weak high frequency fields. It concludes with the derivation of mathematical expressions for the acceleration of particles in a strong high frequency field. Author (TAB)

N69-21929*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNETOHYDRODYNAMIC INDUCTION MACHINE
David G. Elliott, inventor (to NASA) Issued 14 Jan. 1969 (Filed 6 Jul. 1966) 10 p Cl. 310–11
(NASA-Case-XNP-07481; US-Patent-3,422,291; US-Patent-Appl-SN-563650) Avail: US Patent Office

An MHD induction machine was designed in which the MHD induction phenomenon is more closely analogous to that taking place in a conventional rotating induction machine. This was done in order to increase the efficiency of the MHD induction machine to the level attained with rotating machines. By providing end poles which produce a compensating magnetic field, the flux through the conducting fluid in the MHD induction machine is constant at zero slip, minimizing the induction of heating currents therein. The net magnetic field which the fluid traverses is analogous to the rotating field traversed by the rotor conductors in a rotating induction machine at zero slip. Consequently the efficiency of the MHD induction machine is greatly increased. NASA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-20719 Texas A&M Univ., College Station.
HALL EFFECT AND RESISTIVITY MEASUREMENTS ON A SERIES OF REDUCED STRONTIUM TITANATE CRYSTALS
Donald Leon Parker (Ph.D. Thesis) 1968 47 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-11471

Results of Hall mobility measurements on three crystals of strontium titanate in different stages of reduction are reported for the temperature range 190°K–500°K. A significant dependence of the magnitude of the mobility on the density of charge carriers was found, with the mobility *increasing* with an increase in the degree of reduction of the crystals. The carrier concentrations were found to be 2.4×10^{15}, 4.5×10^{17}, and 10^{18} carriers/cm^3 at room temperature with increasing degree of reduction. The sample with the lightest reduction has more than two orders of magnitude fewer carriers than any sample on which Hall mobility measurements have previously been reported. The scattering is attributed to polar interactions with the two highest longitudinal optical modes. A plausibility argument is given to show that the mobility variations from sample to sample are due to a screening effect in the heavily reduced samples. Dissert. Abstr.

N69-20726 Stanford Univ., Calif.
MEASUREMENT OF THE VELOCITY-FIELD CHARACTERISTIC OF GALLIUM ARSENIDE
Jacques Germain Ruch (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-11344

The transport properties of the electrons in GaAs were investigated; i.e., the absolute value of the electron drift velocity, the diffusion coefficient, and the trapping cross section were measured for the first time as a function of the electric field. The specimen consists of a slab of semi-insulating boat-grown GaAs. Thin contacts were evaporated on each face: the cathode contact, less than 1000 Å thick, forms the noninjecting Schottky barrier; the anode is ohmic. A 1 μsec voltage pulse is placed across the diode and produces an essentially uniform electric field within it. An electron beam was pulsed on for less than 0.1 μsec during the voltage pulse. This short burst of electrons was obtained by deflecting the beam of a cathode ray tube past a disk with a hole placed in front of the sample. The electron beam, after being deflected, passes through the cathode contact and generates electrons and holes just in front of it. The electrons move across the diode under the influence of the applied electric field and induce a current in the contacts until they reach the anode. By measuring the transit time of carriers through the region of approximately uniform electric field (the width of the induced current pulse) that extends across the sample of known width, it is thus possible to determine the drift velocity directly. This is equal to the ratio of the sample thickness to the measured transit time of the carriers. Dissert. Abstr.

N69-20728 Illinois Univ., Urbana.
IMPEDANCE AND OTHER PROPERTIES OF GOLD DOPED SILICON P-N JUNCTIONS
Dieter Karl Schroder (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-12191

The diffusion of gold in silicon was studied by the reverse bias capacitance in order to determine diffusion times necessary to achieve gold saturation. Once saturation had occurred it was found that for a given diffusion temperature the gold concentration in the transition region of n^+-p junctions was consistently less than that measured in p^+-n junctions. The charge distribution of the gold recombination centers in the transition (depletion) region was calculated as a function of reverse bias voltages and gold concentration. The key result from these calculations is that for an applied bias of a few volts, the majority of the gold atoms is in the negatively charged state. This is due to the location of the energy levels in the energy gap and the values of the capture cross-sections. The charge state of the gold is mainly negative in the depletion region, regardless of the shallow level dopant. This has the effect that the behavior of gold doped p^+-n junctions is quite different from that of n^+-p junctions, since in these two devices the shallow level impurities in the transition region of the lowly doped side of the junction are of opposing charge.
Dissert. Abstr.

N69-20746 Illinois Univ., Urbana.
AN EXACT ANALYSIS OF THE INTERACTION BETWEEN EDGE DISLOCATIONS AND A FINITE SURFACE LAYER
Richard William Weeks (Ph.D. Thesis) 1968 56 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-12220

The present solution is an exact analysis of the mechanical interaction between edge dislocations and a finite surface layer. Included are both the interaction for a single dislocation, and that due to a group of edge dislocations piled up beneath the layer on a common slip plane under the influence of an applied shear stress. The analysis is general, with no restrictions on either the geometrical or elastic parameters. The dependence of the solutions on the number of dislocations in the pileup, the magnitude of the applied stress, and on the physical parameters is demonstrated numerically, and the results are compared with existing solutions for screw dislocation pileups under similar circumstances.
Dissert. Abstr.

N69-20764 Stanford Univ., Calif.
PHOTOELECTRONIC PROPERTIES OF ZnSe
Gerald B. Stringfellow (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-11355

Imperfections responsible for optical absorption, red and green luminescence emission, and photoconductivity have been investigated in single crystals of ZnSe:Cu. These crystals show p-type dark conductivity corresponding to a Fermi level 0.69 eV above the valence band. Results may be summarized in terms of a multivalent copper impurity model in which Cu^+ and Cu^{++} ions substituting on the Zn sublattice are responsible for the red and green luminescence bands respectively. The green luminescence transition (2.34 eV) is from the conduction band to the empty Cu^{++} center. One of the red transitions is from the conduction band to the empty Cu^+ center (1.97 eV), and another red transition is from a shallow level near the conduction band to the empty Cu^+ center (1.95 eV). The Cu^+ center is also the major sensitizing center in p-type ZnSe:Cu for n-type photoconductivity and the dominant acceptor center controlling p-type conductivity.
Dissert. Abstr.

N69-20798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESONANT MODE ANALYSIS OF THE FITZGERALD APPARATUS
James P. Cusick and Donald R. Behrendt Washington Mar. 1969 22 p refs
(NASA-TN-D-5103) Avail: CFSTI CSCL 14B

Mechanical models are given to represent several nonideal machine modes; the effect of these modes upon drive tube motion is calculated. Fitzgerald's procedure for data analysis is used to calculate the effect of nonideal modes upon the dynamic compliance. The calculations show resonances in the calculated compliance which are indistinguishable from those reported by Fitzgerald.
Author

N69-20820 Oregon Univ., Portland.
MAGNETO-OPTICAL STUDIES OF THE CaO F BAND
William Merle Ziniker (Ph.D. Thesis) 1967 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order no. 68-10028

The fundamentally important defect consisting of an electron trapped at a negative-ion vacancy and known as the F-center occurs in single crystals of the alkaline earth oxides which have been exposed to large fluxes of fast neutrons. The optical absorption band (F-band) of the F-center was located in CaO. The location of the F-band in MgO was also confirmed, in agreement with the results of other types of experiments. The chief experimental technique used in this work was optical Faraday rotation. The apparatus used permitted measurement of sample rotations in the spectral range of 7000Å to 2500Å and at temperatures of 4.2°K to about 1.8°K. Magnetic fields up to 45,000 gauss were available. The experiments used to locate the F-band combined Faraday rotation with microwave absorption.
Dissert. Abstr.

N69-20829*# Oklahoma State Univ., Stillwater. Dept. of Physics.
HYPERELECTRONIC POLARIZATION, CONDUCTION, AND POSSIBLE SUPERCONDUCTION IN MACROMOLECULAR SOLIDS Interim Technical Report
Roger D. Hartman (Ph.D. Thesis) Oct. 1967 312 p refs
(Contract NAS5-10323)
(NASA-CR-100424) Avail: CFSTI CSCL 20L

The experimental response was studied of conduction, polarizability and paramagnetic resonance to variations in: temperature, extreme pressure, field strength (ac and dc), frequency, sample morphology and geometry, mechanical and heat treatment of the sample, and chemical structure. The range of variables included: (1) temperature, 1.5° to 450°K; (2) pressure, 0.0 to 32 kbar; (3) electric field, 0 to 300 V/cm; and (4) frequency, dc to 100 Khz. Conductivities, σ, ranging from 3×10^{-3} to 10^{-10} mho/cm and dielectric constants, ϵ_r, ranging from 12 to 70,000 were observed. For those polymers examined, it was found that they exhibit: E-field dependency of σ and ϵ_r; strong pressure dependency of σ and ϵ_r; strong temperature dependency of σ and ϵ_r; and dispersions in σ and ϵ_r, with characteristic relaxation times of $\approx 10^{-3}$ to 10^{-4} sec.
Author

N69-20892 New Mexico Univ., Albuquerque.
AN X-RAY DIFFRACTION STUDY OF THE PLASTIC CRYSTAL PHASE
Donald Russell Wheeler (Ph.D. Thesis) 1968 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-11670

Experimental methods were developed that allowed Debye–Scherrer patterns of plastic solids to be obtained at temperatures from −90°C to +30°C. These methods were

applied to cyclohexanol, cyclohexane, cyclopentanol and camphene. Cyclopentanol was found to be hexogonal in both its rotational phases. The high temperature phase is hexagonal, close-packed with a + 5.88A and c = 9.45A at −30°C. The low temperature phase has six molecules per cell, and the lattice constants are a = 10.1A and c = 9.49A at −50°C. The lattice constant of cyclohexane was found to be 8.673A at −34.6°C and 8.738A at −5.6°C. The lattice constant of cyclohexanol fits the equation a(A) = 8.425 + 0.00129 T(°K) for temperatures from −27°C to +3.4°C. From these lattice constants the vacancy concentrations in cyclohexane and cyclohexanol were found to be less than 0.5% and 0.3%, respectively. Dissert. Abstr.

N69-20991# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

CONTRIBUTION TO THE STUDY OF POINT DEFECTS FORMED IN NICKEL BY ELECTRON BOMBARDMENT [CONTRIBUTION A L'ETUDE DES DEFAUTS PONCTUELS CREES PAR BOMBARDEMENT ELECTRONIQUE DANS LE NICKEL]

Jean-Louis Oddou (Ph.D. Thesis) Dec. 1968 63 p refs In FRENCH; ENGLISH summary
(CEA-R-3605) Avail: CFSTI

After a short account of the experimental techniques employed, the experimental results obtained with pure nickel samples are discussed. The appearance of successive annihilation stages of the point defects created by electron bombardment is established by isochronal heat treatments and the annihilation kinetics and the corresponding activation energies are determined. The effect of the incident particle dose is also studied. The experimental results are then compared with R.A. Johnson's theoretical calculations of the stability and migration of point defects in nickel, taking into account the results obtained by Paretto in magnetic after-effect measurements which lead to a model in good agreement with calculations and experiment for the first stages. The behaviour of nickel doped by certain impurities is studied and the rate of increase of resistivity (function of sample purity) is investigated. Two explanations, either a deviation with respect to Mathiessen's law, or an increase of the number of defects formed in the presence of impurity atoms are proposed. Finally, a study of the resistivity recovery of the doped samples suggest an order of magnitude for the binding energy interstitial/impurity atom in the nickel matrix. Author (ESRO)

N69-21054 Rochester Univ., N. Y.

DYNAMICS OF TRIPLET EXCITONS IN POLYACENE CRYSTALS

Charles Edward Swenberg (Ph.D. Thesis) 1968 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-9397

An improved theoretical formulation of the triplet exciton bimolecular rate constant in organic crystals is developed which allows for explicit calculations of all reaction constants pertinent to mutual exciton annihilation of triplets, and properly accounts for the anisotropy of the interaction responsible for the bimolecular annihilation. A simplified model for the effective density of final electronic state is developed and explicit calculations are performed assuming that only the totally symmetric intramolecular stretching modes are active and by including intermolecular vibrations phenomenologically. Calculations of the bimolecular rate constant and diffusion tensor, both with and without the inclusion of charge-transfer interactions, are performed for solid naphthalene, anthracene, and tetracene. Dissert. Abstr.

N69-21088 Stanford Univ., Calif.

THE FERROELECTRIC TRANSFORMATION IN BARIUM TITANATE

Brenton Lewis Mattes (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-11324

The model is studied of the transformation from the non-polar cubic phase to the polar ferroelectric phase in $BaTiO_3$; this accounts for the latent phase. It is shown that: (1) when the deformation strains and polarization are taken into account, the onset of the transformation is suppressed. The suppression arises from the premise that there is a priori no preferential direction in the bulk of the crystal for the spontaneous alignment of the polarization. (2) the spontaneous transition to the ferroelectric phase is a thermally activated non-equilibrium transformation. The transition is triggered at a critical temperature when the deformation strain energy is equal to a particular thermal fluctuation energy within each unit cell (e.g., that of the Ti^{4+} ion). This criterion accounts for the spontaneous tetragonal, orthorhombic and rhombohedral phase transformations. (3) numerous properties above and below the spontaneous transition are accounted for by this model. Dissert. Abstr.

N69-21298 Michigan State Univ., East Lansing.

GROWTH STUDIES OF VACUUM EVAPORATED THIN METAL FILMS DEPOSITED ON AMORPHOUS SUBSTRATES

James A. Baumbach (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-11037

The growth characteristics for metal films of indium, lead, and tin, and a bimetallic film of lead and indium have been investigated for a range of film thicknesses. The films were prepared by thermal evaporation at residual pressures of 2×10^{-8} torr and lower; they were found to exhibit similar characteristics, with the minor exception that tin becomes continuous much sooner than the other metals for a comparable quantity of deposited metal. During the archipelago stage the characteristics of growth are defined by three secondary stages. The first stage of growth occurs just after nucleation when the film contains uniform, non-interacting nuclei. The nuclei continue to grow primarily by the addition of migrating surface atoms. The second stage begins when intermediate sized nuclei coalesce to form larger ones. Finally, coalescence of large islands and large island assimilation of small nuclei mark the third growth stage. In addition, a method for contact angle measurement within the electron microscope, and the discovery of non-assimilated nuclei beneath large islands are discussed. Dissert. Abstr.

N69-21318# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

A STUDY OF SOME LATTICE DEFECTS WITH THE HELP OF CHANNELED α PARTICLES [ETUDE DE QUELQUES DEFAUTS CRISTALLINS A L'AIDE DE PARTICULES α CANALISEES]

Yves Quere (Ph.D. Thesis—Paris Univ., 1 Jul. 1968) Dec. 1968 71 p refs In FRENCH; ENGLISH summary
(CEA-R-3606) Avail: CFSTI

A method is described in which a metallic foil is irradiated by isotropic α particles. The thickness of the foil is such that only channeled particles can traverse it. The emerging flux, a function of the local concentration of defects, falls on a collector where an image of the foil is formed. The influence of grain- or twin boundaries, stacking faults and dislocations, is apparent. In a quantitive study the effect of a dislocation is represented by the presence of a coaxial dechannelingcylinder of diameter: = $[bdaE/\alpha Z_1 Z_2 e^2]1/2$, where b is the Burgers vector, d the interatomic distance along the channel, a the screening radius of the interaction between the particles (Z_2) and the metal (Z_1), E the energy of the particles and α a numerical parameter. There is reasonable agreement with experimental results. Channeling patterns, observed

in all metals, are described. They are more numerous if the metal has been treated at some time in gaseous atmospheres. They correspond to zones, on the metal, situated on the entrance side of particles. It is proposed that in these zones, gaseous atoms strengthen the channels and enhance channeling. Author (ESRO)

N69-21351# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
TRANSVERSE IMPACT IONIZATION IN SEMICONDUCTORS
Helmut Schmidt and Donald J. Nelson Jan. 1969 19 p refs
(D1-82-0815) Avail: Issuing Activity

The electron distribution function in the presence of crossed electric and magnetic fields is calculated, for a n-type semiconductor with isotropic electron scattering by acoustical and optical phonons. The results are applied to a semiconductor rod, subject to a longitudinally applied electric field and a transverse magnetic field. It is found, in agreement with previous measurements, that the ionization rate can increase with increasing magnetic field, due to the generated Hall electric field. The effect is closely related to a magnetic trapping of electrons in the low energy, high mobility region. Author

N69-21356# Purdue Univ., Lafayette, Ind.
AN ESR AND ENDOR STUDY OF A /111/ DEFECT IN LiF
Yuan Hou Chu (Ph.D. Thesis) Jan. 1969 89 p refs
Avail: Issuing Activity

Results of ESR and ENDOR measurements and analysis of a ⟨111⟩ oriented defect in pure LiF are presented. This paramagnetic defect is produced at low temperatures by X-ray or electron radiation. The ENDOR from 13 nonequivalent sets of lattice nuclei have been obtained by fitting the ENDOR spectrum to a spin Hamiltonian. Results of this ESR and ENDOR study show that this ⟨111⟩ defect is equivalent to an interstitial fluorine atom that has the form of a negatively charged diatomic molecule (e.g., F_2^-) with its molecular axis oriented along a ⟨111⟩ direction. Calculations of the dipole–dipole hyperfine tensor permitted the distortion of the lattice about the defect to be determined. Except for the nearest neighbor fluorines, the relaxation of the lattice nuclei is away from the defect. Author

N69-21500*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERCONDUCTIVE DUST CORES FOR INDUCTIVE ELEMENTS
Russell J. Jirberg Washington Apr. 1969 38 p refs
(NASA-TN-D-5137) Avail: CFSTI CSCL 20C

The use of superconductive dust as a core filler for inductive coils was investigated as a means of producing magnetically variable inductive elements. Both lead and niobium-filled cores were studied in static background magnetic fields. The observed inductance variations and the origin of alternating-current losses are discussed in relation to their superconducting properties. Author

N69-21524# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ENERGY BAND STRUCTURE OF SEMICONDUCTORS Final Scientific Report, 1 Feb. 1966–30 Nov. 1968
Frank Herman, Richard L. Kortum, Irene B. Ortenburger, and John P. Van Dyke Dec. 1968 356 p refs
(Contract AF 19(628)-5750)
(AD-681458; AFCRL-68-0631) Avail: CFSTI CSCL 20/12

The electronic structure and related optical properties of over 50 elemental and compound semiconductors were investigated. The studies have covered the diamond-type crystals; cubic and hexagonal SiC; several III-V, II-VI, and I-VII compounds; a number of II-IV compounds; and various IV-VI compounds; among others. In most cases one is able to obtain a qualitatively reliable energy band model by carrying out a first-principles OPW (orthogonalized plane wave) energy band calculation using a simple but physically realistic crystal potential. With such an energy band model in hand, one is usually able to account for a wide variety of experimental information. A method for obtaining more accurate energy band models was developed. The empirically-refined first-principles method has been used with considerable success in a wide variety of applications. The present report includes the complete texts of several recent scientific papers which adequately discuss and illustrate the empirically-refined first-principles approach to energy band problems. Author (TAB)

N69-21538# California Inst. of Tech., Pasadena.
SPONTANEOUS AND STIMULATED LIGHT EMISSION DUE TO RADIATIVE RECOMBINATION IN FORWARD BIASED LEAD TELLURIDE p-n JUNCTIONS
Peter John A. Zoutendyk May 1968 140 p refs
(Contract Nonr-220(50))
(AD-682220; TR-6) Avail: CFSTI CSCL 20/12

The results of a number of experiments on the light emission and electrical characteristics of lead telluride p-n junction diodes have been presented. The capacitance-voltage data indicate that the vapor diffusion of an n-type layer into p-type bulk material produced an abrupt junction. At low current levels and temperatures (4.2K to 20.4K), the current voltage data exhibit a temperature independent exponential variation of current with junction voltage. The current-voltage data, together with the total intensity data as a function of diode current, indicate that photon-assisted tunneling is the dominant injection mechanism at low current levels. As the current level is increased, the injection mechanism changes from photon-assisted tunneling to thermionic emission. The spontaneous emission of light in the thermionic injection region is apparently influenced by impurity trapping levels in the band-gap. Stimulated light emission occurs at high injection levels in those diodes where a reflecting cavity is formed by cleaving the ends of the crystal. The image-scan and far-field diffraction data indicate that the stimulated electromagnetic modes are confined to within approximately a diffusion length of the junction. The data indicate that the mode confinement is due to the optical gain in the diode cavity, a gain which obtains in the region where a population inversion exists. Therefore, both the gain and the mode profiles are diffusion controlled. Author (TAB)

N69-21598# California Univ., Berkeley. Div. of Applied Mechanics.
A CLASS OF SIMPLE SOLIDS WITH FADING MEMORY
M. J. Crochet and P. Naghdi Dec. 1968 51 p refs
(Contract N00014-67-A-0114)
(AD-682214; AM-68-9) Avail: CFSTI CSCL 20/11

This paper is concerned with non-isothermal constitutive equations and related thermodynamical results for a class of simple solids with fading memory. Our development is partly motivated by, and also bears on, thermo-rheologically simple materials. After motivating and developing the forms of the constitutive relations (and the expression for internal dissipation) within the framework of the theory of simple materials with fading memory, detailed attention is given to the construction of a non-isothermal finite linear theory of viscoelasticity. Some remarks on simplification of the results and their forms when the deformation is infinitesimal are also included. Author (TAB)

N69-21605# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.

DISSOCIATED PRISMATIC DISLOCATION LOOPS

A. K. Eikum Dec. 1968 8 p ref

(AD-682052; D1-82-0802) Avail: CFSTI CSCL 20/2

Transmission electron microscopy observations on heterogeneous precipitation in dilute aluminum-base silver alloys tend to support a previously proposed model for dissociated prismatic dislocation loops. During the initial stage of precipitation, the perfect dislocation loop splits into partials, thus forming a continuous ribbon of precipitate, on the pair of close-packed planes which are common to the perfect Burgers vector. Author (TAB)

N69-21633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN ELECTRICAL AND PHOTOELECTRIC PROPERTIES OF AN HgTe-Zn-Te SYSTEM

A. D. Shneider, D. I. Tsyutsyura, V. V. Makarenko, and H. M. Hryhoravych May 1968 9 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 10, no. 8, 1965 p 915–917

(AD-681667; FTD-HT-23-25-68) Avail: CFSTI CSCL 20/12

The temperature dependence of the Hall coefficient (R) and the conductivity of HgTe and of several solid solutions of HgTe-ZnTe with small content of ZnTe were investigated. The temperature dependence of the Hall coefficients of three types of the samples is typical of hole semiconductors with large mobility ratios. The curves indicate intrinsic conductivity. The temperature dependence of the thermoelectric power indicates that at a sufficiently low temperature the Hall coefficient changes sign. The electron mobility at 78K has been determined from data on the intrinsic conductivity. The width of the forbidden band increases practically linearly with increasing ZnTe content. The kinetic behavior of the photoconductivity is complex, with long-lasting components predominating. Author (TAB)

N69-21713# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MECHANISMS OF THE FORMATION OF RADIATION DEFECTS IN CRYSTALS

S. V. Starodubtsevs and A. E. Kiv Mar. 1968 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uz. SSR, Ser. Fiz. Mat. Nauk (Tashkent), v. 7, no. 2, 1963 p 41–43

(AD-681670; FTD-HT-23-193-68) Avail: CFSTI CSCL 20/2

A process of radiation destruction in germanium crystals, generated by 100-kev electron bombardments, has been studied. The K-shell ionization cross section is given, and the assumption is made that the crystal thickness is much smaller than the electron mean free path. An expression is derived for the concentration of probable pair distribution of ionized atoms and eventually of the atom concentration displaced by a single electron. It is shown that in valence crystals, with sufficiently low hole mobility, the mechanism of the formation of displacements is even more effective when associated with valence electron transfer and outer shell ionization. TAB

N69-21747# Technische Hochschule Darmstadt (West Germany). Physikalisches Institut.

INVESTIGATIONS OF SOME OXIDE CRYSTALS BY ESR AND OPTICAL METHODS Final Scientific Report

B. Elschner 1 Sep. 1968 36 p refs

(Contract AF 61(052)-817)

(AD-681468; AFCRL-68-0614) Avail: CFSTI CSCL 20/12

The mineral Benitoite was investigated by Electron-Spin-Resonance (ESR). A FORTRAN-program was written to compute the constants of the Spin-Hamiltonian from the resonance magnetic fields. It also computes the energy eigenvalues of the Spin-Hamiltonian. These are in good agreement with experiment thus indicating that the right Spin-Hamiltonian was chosen. This program was used to set up the Spin-Hamiltonian of gadolinium ions Gd(3+) in YCl3.6 H2O and of iron ions Fe(3+) in SnO2. SnO2-crystals, both undoped and doped with vanadium ions V(4+) and iron ions Fe(3+), were grown from the vapor phase and investigated by measuring resistivity, optical transmission, and ESR. Ruby-crystals with different concentrations of chromium ions Cr(3+) were grown with aid of a Verneuil set up. The fluorescence lifetime was measured at various temperatures and concentrations using a sampling technique according to Zarowin. Several crystals of the boracite-type were grown with aid of a transport-reaction according to H. Schmid and the optical transmission was analyzed. The ESR-Spectrum of Ni-J-boracite was recorded and interpreted by an effective spin S = 1/2. A giant pulse LASER was built and frequency doubling of boracites was investigated. The magneto-electric effect of Ni-J-Boracite was measured. Author (TAB)

N69-21784# California Univ., Livermore. Lawrence Radiation Lab.

A MULTIELECTRONIC THEORY OF LOCAL STATES NOT BASED ON MACROSCOPIC APPROXIMATION AND THE METHOD OF EFFECTIVE MASS [BAGATOELEKTRONNA TEORIYA LOKALNIKH STANIV SHCHO NE SPIRAETSYA NA MAKROSKOPICHNE NABLIZHENNYA I METOD EFEKTIVNOI MASI]

Z. Ya. Evseev Aug. 1968 15 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 11, no. 8, 1966 p 829–835

(UCRL-Trans-10260; PB-180822T) Avail: CFSTI CSCL 20L

A computation is performed in accordance with the microtheory of polaron states in an NaCl crystal, where only the longitudinal optical oscillations of the lattice are taken into consideration. The author takes into account the expansion of the polaron function in Bloch functions of the entire first Brillouin zone and the interaction of electrons with phonons of all branches of any wave length. It is shown that for radii of the states r is greater than 2d, where d is the lattice constant, the approximation is perfectly valid, but it cannot be applied in the case of states of smaller radii, where the discreteness of the crystal structure has a greater effect. USGRDR

N69-21778# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ACADEMY OF SCIENCES OF THE GEORGIAN SSR. INSTITUTE OF PHYSICS. ELECTRONIC AND IONIC PROCESSES IN SOLIDS, VOLUME 2, 1965 (SELECTED ARTICLES)

E. L. Andronikashvili et al 21 Mar. 1968 28 p refs Transl. into ENGLISH from Akad. Nauk GruSSR, Inst. Fiz. Elektr. i Ionnyye Protsessy v Tverdykh Telakh (USSR), v. 2, 1965 p 3–13; 35–39

(AD-682105; FTD-HT-23-123-68) Avail: CFSTI CSCL 20/12

Contents: Radiative variation of dislocation density in alkali-halide crystals irradiated in a reactor at normal and low temperatures; and Low frequency internal friction in lithium fluoride crystals. TAB

N69-21827# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE COEFFICIENTS OF ACOUSTIC NMR ABSORPTION IN TRIGONAL CRYSTALS

S. B. Grigorev et al Mar. 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 10, no. 2, 1967 p 209–213

(AD-681634; FTD-HT-23-198-68) Avail: CFSTI CSCL 20/2

The report describes a method for calculating the coefficients of resonance absorption of sound waves by a nuclear-spin system. The intensity and angular dependence of the acoustic NMR signal in ionic trigonal crystals is calculated. TAB

N69-21837# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
LONGITUDINAL MAGNETORESISTANCE OF PURE SINGLE-CRYSTAL COPPER
Alan F. Clark and Robert L. Powell. Repr. from Phys. Rev. Letters, v. 21, no. 12, 16 Sep. 1968 p 802–804 refs
PB-180898; R-470) Avail: CFSTI CSCL 20L

The longitudinal magnetoresistance was measured along the (100) direction of a pure single crystal of copper. The temperature dependence of the saturation ration, rho (B = sat.)/rho (B = 0), is given between 4 and 35 degrees K. A limit is placed on the diffusion approximation for small-angle electron scattering and it is suggested that the assumption of a relaxation time or of a mean free path parallel to the velocity is not valid for some types of impurity or low-temperature phonon scattering. Author (USGRDR)

N69-21870# Technische Hochschule Munchen (West Germany).
ELECTRON-PHOTON INTERACTION AND DONOR BAND TRANSFERS OF CRYSTAL ELECTRONS IN THE STATIONARY ELECTRIC FIELD [ELEKTRON-PHONON-WECHSELWIRKUNG UND DONATOR BAND UEBERGAENGE VON KRISTALL-ELEKTRONEN IM STATIONAEREN ELEKTRISCHEN FELD]
Klaus Hacker (Ph.D. Thesis) 1968 62 p refs In GERMAN
Avail: CFSTI

Discussed are electron phonon interactions in crystals exposed to a strong static electric field and the observed Wannier–Stark plateaus in the crystal's electron spectra. This effect is caused by substitution of electron impulses in field direction with quantum number energy intervals proportional to the surrounding field energy Transl. by G.G.

N69-21884# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physics Inst.
ATOMIC VIBRATIONS IN STRESSED CRYSTAL LATTICES BY INELASTIC SCATTERING OF NEUTRONS Final Scientific Report, 1 Oct. 1962–30 Sep. 1968
P. Weinzierl Nov. 1968 14 p refs
(Contract AF 61(052)-638)
(AD-681511; AFOSR-69-0033TR) Avail: CFSTI CSCL 20/2

A scattering chamber for inelastic neutron scattering at pressures up to 3000 atm was constructed. This pressure proved to be large enough to induce in some materials phonon frequency shifts of the order of 1% which are measurable by the inelastic neutron scattering technique. Measurements on pressure induced frequency shifts of some phonons in lead and sodium iodide were made. The phonon frequency distribution in the random binary alloy Pt + Cu (5%) was compared with that of a pure Pt sample. Also measured was the change of phonon frequency distribution of very fine MgO powders against that of large-crystalline samples. Author (TAB)

N69-21910# Illinois Univ., Urbana. Coordinated Science Lab.
TEMPERATURE DEPENDENCE OF THE RESISTIVITY AND HALL EFFECT OF THIN CdS FILMS
Ricardo Jimenez Dec. 1968 62 p refs
(Contracts DAAB07-67-C-0199; DAAK02-67-C-0546; Grant NSF-GA-1239)
(AD-681719; R-401) Avail: CFSTI CSCL 20/12

A system was set up to study the resistivity and Hall mobility in thin semiconductor films as a function of temperature. For vacuum deposited CdS films exhibiting photoluminescence resistivity data were taken for the temperature range from 77K to 400K, while the Hall mobility was measured between 300K and 400K. A plot of the resistivity data showed an exponential variation with temperatures from 250K to 400K. From theoretical considerations, it was inferred that the donor levels were not discrete within the energy bandgap. No systematic variation of the resistivity was observed at temperatures between 77K and 200K. The resistivities of the samples varied over a wide range from 1 ohm-cm to 10 to the 7th power ohm-cm at 300K. The Hall mobility data for the CdS films showed mobilities between one and two sq cm/V-sec, and also a consistent exponential variation with temperature. The measured values of the mobility and its exponential behavior were in good agreement with reported values for CdS films. Author (TAB)

N69-21914# Illinois Univ., Urbana. Coordinated Science Lab.
ELECTRICAL PROPERTIES OF SOME VACUUM DEPOSITED INSULATING FILMS
Owen Reilly Jan. 1969 65 p refs
(Contracts DAAB07-67-C-0199; DAAK02-67-C-0546)
(AD-681720; R-403) Avail: CFSTI CSCL 11/7

Materials can be classified as conductors, semiconductors, or insulators. The distinguishing difference among these classes is the resistivity. Conductors generally have resistivities of the order of 0.00001 ohm-cm; semiconductors fall in a range around 1 ohm-cm; and insulators have resistivities near 10 to the 10th power ohm-cm. This large difference in resistivity of the three classes of materials is the basis of their engineering applications. The resistivities of all three classes may be functions of many parameters, including temperature, purity, conditions of preparation, and the field strengths applied to them. The experimentally determined resistivities for a group of vacuum deposited thin film insulators is presented. Author (TAB)

N69-21915# Technische Hochschule Munchen (West Germany).
INFLUENCE OF LATTICE STRUCTURE AND TEMPERATURE ON THE BACK SCATTERING OF PROTONS ON COPPER IN THE ENERGY RANGE OF 40 TO 120 KeV [UEBER DEN EINFLUB DER GITTERSTRUKTUR UND TEMPERATUR AUF DIE RUECKSTREUUNG VON PROTONEN AN KUPFER IM ENERGIEBEREICH VON 40 BIS 120 KeV]
Rainer Behrisch (Ph.D. Thesis) 1968 36 p refs In GERMAN
Avail: CFSTI

Energy and angular distributions of the backscattered hydrogen atoms were measured with a silicon-junction radiation counter having an energy resolution of 7.5 keV. The energy distribution showed a strong increase toward low energies. For an angle of incidence of 43° relative to the surface normal, the angular distribution of a plane not falling in a blind sector is maximum for an angle of emergence of about 65°; the minima are superimposed in the closely packed directions. Energy distribution curves calculated by a simple model show toward low energies a smaller increase than was measured. The vicinity of the blind minimum occurring in the (100) direction was recorded photographically and measured with the counter, and diagrams with lines of equal intensity were produced. Cuts were placed parallel to a (210) plane through the (100) minimum, resulting in minima which become narrower with increasing ion energy and convert from the box form to a triangular shape with increasing crystal temperature. The exact forms of the minima agree only approximately with the calculated curves. In the calculations it was not taken into account that the ions undergo many small angular deflections when passing through the lattice. Transl. by K.W.

N69-21932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL EXPANSION OF CERTAIN SULFIDES OF TRANSITION METALS
E. M. Dudnik and U. Kh. Oganesyan Aug. 1968 8 p refs Transl. into ENGLISH from Poroshkovaya Met. (USSR), v. 8, no. 2, 1968 p 60–62
(AD-681613; FTD-HT-23-262-68) Avail: CFSTI CSCL 20/2

The following properties were determined in this paper: coeff. of thermal expansion; characteristic temp.; mean quadratic amplitude of elastic vibrations in A.; m.p.; modulus of elasticity. Some lattice structural implications of the observed variations in the above values are discussed. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-20897 Texas A&M Univ., College Station.
AN INVESTIGATION OF THE NATURE OF MICROSTRUCTURAL DAMAGE IN A FILLED ELASTOMERIC COMPOSITE MATERIAL
David Meacham Elliott (Ph.D. Thesis) 1968 99 p
Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-11455

The principal objectives were to define those elements which are the most influential in determining the extent of microstructural damage and to develop the apparatus and techniques necessary to measure those elements accurately and directly. An expression for dilation as a function of strain based on a generalized model of the process of dewetting and vacuole growth was derived. From this expression, it was determined that the two elements most influential in determining the extent of microstructural damage are the dewetting distribution function and the rate at which individual vacuoles grow with strain. An hydraulic microstraining stage and an optical-photographic system were designed and constructed. This apparatus was utilized to measure the dewetting distribution function and the rate of vacuole growth for a polyvinyl chloride-glass bead composite. Dissert. Abstr.

N69-21082*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CRITERIA FOR SEPARATION OF IMPINGING STREAMS OF HYPERGOLIC PROPELLANTS
Raymond Kushida and John Houseman 15 July 1968 12 p refs
(Contract NAS7-100)
(NASA-CR-100460; JPL-TM-33-395) Copyright. Avail: CFSTI CSCL 21I

Two theoretical models of stream separation in impinging unlike doublets are advanced. These models are complementary, in that one applies at low pressure and the other at relatively higher pressures. The first model is based on the attainment of the bubble-point temperature at the stagnation point of the jets. In the second model, for higher pressures, the gas phase reactions become so rapid that an insulating gas film can be formed between the two impinging liquid jets, preventing any contact between liquid phases. Using available data on rates of reaction for the N_2O_4–N_2H_4 propellant combination, estimates of the region where stream separation would or would not occur have been made. Curves based on the bubble-point limitation depend strongly on the variation of vapor pressure with propellant feed temperature. The gas film model exhibits no such dependence. The $-3/2$ power dependence on pressure of this latter model is due to the sensitivity of gas phase reactions to pressure. The theory is equally applicable to round jet and to flat sheet injector elements. The experimental data obtained appear to correlate with the theory, in that the smaller-diameter injectors (less than 0.02 in.) show no stream separation, but the larger ones (greater than 0.06 in.) do. Author

N69-21243# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
THEORETICAL THERMODYNAMIC DATA AND CALCULATIONS OF PERFORMANCE OF THE ROCKET PROPELLANTS SYSTEM METHANE/NITROGEN TRIFLUORIDE FOR A CHAMBER PRESSURE OF 0.968 kp/SQ CM [THEORETISCHE THERMODYNAMISCHE DATEN UND LEISTUNGSBERECHNUNGEN DER RAKETENTREIBSTOFFKOMBINATION CH SUB 4/NF SUB 3 FUER EINEN BRENNKAMMERDRUCK VON 0968 kp/cM SUP 2]
W. Buschulte and H. Koch Sep. 1968 25 p refs in GERMAN; ENGLISH summary
(DLR-Mitt.-68-23) Avail: CFSTI

For the rocket propellant system CH_4/NF_3 and a chamber pressure of 0.968 kp/cm^2 the main theoretical thermodynamic values, the characteristic rocket propulsion figures and the vacuum specific impulse was computed and shown in diagrams and tables in dependence of the mixture ratio and the expansion ratio. Author

N69-21282 Stanford Univ., Calif.
THE USE OF PREFORMED SOLID PARTICLES IN COLLOIDAL PROPULSION
John Paul Kesserling (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-11313

In order to determine which powders would be suitable as colloidal rocket propellants, experimental and analytical investigations of the feeding and charging of solid particles have been carried out. Feeding experiments were conducted with a rotating-screw device in both air and vacuum, and the maximum possible powder flow rate compared with that actually obtained. Particle charging experiments were carried out with a hot-cathode charging device, in which a heated tungsten filament was used as a source of bombarding electrons. The mass flow rate and total current in the charged colloid beam were measured with suitable instruments. The feeding experiments conducted have demonstrated the great effect of the surrounding medium on particle flow, with some materials having greater feed rates in vacuum, and some having greater feed rates in air. Dissert. Abstr.

N69-21601# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
STRAND SIZE AND LOW PRESSURE DEFLAGRATION LIMIT IN A COMPOSITE PROPELLANT
Roy E. Cookson and John B. Fenn Dec. 1968 18 p refs
(Contract N00014-67-A-0226; Proj. Squid)
(AD-682244; SQUID-TR-PR-116-PU) Avail: CFSTI CSCL 21/2

The low pressure deflagration limit was determined for a composite ammonium chlorate propellant over a range of pressures from 35 torr to 235 torr. The independent variable was strand size in terms of cross-section dimensions. A linear relation was found between the hydraulic radius of the strand and the low pressure limit. It was thus possible to extrapolate and determine the low pressure limit for a strand of infinite extent. At this limit it would seem that heat losses could only be by radiation from the surface. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 33 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-20760*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NONAEROSPACE USES OF CHEMICAL ROCKET TECHNOLOGY
Walter T. Olson 11 Dec. 1968 31 p refs
(NASA-TM-X-52550) Avail: CFSTI CSCL 21H

About 750 of the 3,000 items that NASA has so far identified and published as potentially useful outside of the aerospace field can be identified with chemical rocket technology. A number of technical fields can each be shown to contain examples of chemical rocket technology that is actually used for other than aerospace purposes. These uses range from broad advances in the technical field to smaller applications, such as gadgets and inventions. Some of these fields are chemistry, fluid systems (pipes, valves tanks, etc.), cryogenics, rotating machinery (turbines, pump, bearings, seals, lubricants), instruments and controls, computer software, metals, nonmetallic materials, and fabrication. In effect, chemical rocket technology has turned out to be technically productive for the nonaerospace as well as the aerospace field. Author

N69-20763*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A 10 DEG CONICAL PLUG NOZZLE USING A TURBOJET GAS GENERATOR
Sidney C. Huntley and Nick E. Samanich Mar. 1969 58 p refs
(NASA-TM-X-52570) Avail: CFSTI CSCL 21E

Internal performance data were obtained over a pressure ratio range from 2 to 30 and corrected secondary weight flow ratios from 2 to 8% with shrouds up to about 1/4 the total plug length and with plug truncations of 100%, 75%, and 50% of full length plug. The results indicate thrust coefficients of 98% and 97.5% were possible at low and high pressure ratios, respectively. Half of a 2% thrust loss with 50% plug was regained by removal of base and venting cavity. Individual thrust components are shown. Author

N69-20785# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
AIR INTAKES FOR A MACH 7 AIRCRAFT [PRISES D'AIR POUR LE VOL A MACH 7]
Jacky Leynaert 1968 18 p refs In FRENCH; ENGLISH summary Presented at the 5th AFITAE Colloq. on Appl. Aerodyn., Poitiers, FRANCE 6–8 Nov. 1968
(ONERA-TP-658) Avail: CFSTI

With a fixed exhaust throat, it is interesting to organize first a subsonic, then a supersonic combustion when the aircraft speed M_0 increases from Mach 2 to Mach 7. According to the Mach number M_2 just before combustion, the configuration of the intake will be different. For $M_0 = 7$, a nominal $M_2 = 4$ will give a large intake throat that will be satisfactory within a large flight speed range; a nominal $M_2 = 2$ will give a poor adaptation at low speeds, with a supercritical regime at high speed. Preliminary wind-tunnel tests, performed at ONERA, are described. The final choice of an air-intake will depend on hitherto unknown supersonic combustion characteristics. Author (ESRO)

N69-20800# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESEARCH OF AN OPTIMUM SOLUTION FOR A FIXED GEOMETRY RAMJET, IN THE MACH 3 - MACH 7 RANGE, WITH SUCCESSIVELY SUBSONIC AND SUPERSONIC COMBUSTION
Roger Marguet and Charles Huet 1968 30 p refs Presented at the 5th AFITAE Colloq. on Appl. Aerodyn., Poitiers, France, 6–8 Nov. 1968 Submitted for publication
(ONERA-TP-656E) Avail: CFSTI

The study of an optimal solution for a booster ramjet in the Mach number range 2.5 to 7 leads to configurations of variable geometry air intakes and nozzles; these appear to be hardly feasible in practice. In this view, the possibilities given by using successively subsonic and supersonic combustion, in the same fixed geometry burning chamber, were examined. The performance of this engine is approaching that of the optimal solution with adapted geometry. This paper shows the interest of a Mach 3 to 7 engine with fixed geometry using sub-and supersonic combustion. Some indications of the general layout of this engine are given, including the appropriate fuel. Author (ESRO)

N69-20812*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMUM SPECIFIC IMPULSE FOR ELECTROSTATIC ENGINES USED FOR SATELLITE RAISING TO SYNCHRONOUS EQUATORIAL ORBIT
Frank J. Hrach 1969 21 p refs
(NASA-TM-X-52568) Avail: CFSTI CSCL 21C

An expression for optimum specific impulse for minimum required propulsion time is derived for electrostatic engines used for raising a satellite from an initial circular orbit to a synchronous equatorial orbit. The results of this analysis are applicable to the problem of increasing the mass that can be put into synchronous equatorial orbit above the value that a particular booster can put into this orbit directly. It is assumed that the initial orbit is circular, has an inclination of 28.5°, and an unspecified altitude. The power and final mass of the satellite are assumed to be specified. An example mission is considered. Author

N69-20876*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT PERFORMANCE OF FW-4D SOLID-PROPELLANT ROCKET MOTOR ON DELTA 50 (AIMP-E)
Daniel Dembrow Washington Mar. 1969 47 p refs
(NASA-TN-D-4987) Avail: CFSTI CSCL 21H

The in-flight performance is summarized of the FW-4D solid-propellant rocket motor used as the third stage of the Delta 50 launch vehicle for the first Anchored Interplanetary Monitoring Platform (AIMP-E), Lunar Explorer. This was the first Delta to use a digital integrating accelerometer for accurately determining third-stage velocity. The instrumentation included a rocket-chamber pressure transducer, a longitudinal accelerometer, and a counter and encoder for converting the digital accelerometer output into two forms: integrated acceleration × time (i.e., velocity) pulses and accumulated pulse count. The correlation between predicted and observed third-stage performance was excellent. Author

N69-20879*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
STUDY OF INDUCER LOAD AND STRESS Interim Report, 15 Feb. 1968–15 Oct. 1968
H. J. Barten, L. L. Coons, and R. E. Davis 2 Apr. 1969 155 p refs
(Contract NAS3-11216)
(NASA-CR-72514; PWA-FR-3015) Avail: CFSTI CSCL 21H

A program of analysis, design, fabrication, and testing is being conducted to develop computer programs for predicting rocket engine turbo-pump inducer hydrodynamic loading, stress magnitude and distribution, and vibration characteristics. This report covers the analysis and design portion of the program. Methods of predicting blade loading, stress, and vibration characteristics were selected from a literature search and used as a basis for the computer programs. A test inducer was designed representative of typical rocket engine inducers and instrumentation was selected to provide measurements of blade surface pressures and stresses for correlation with the prediction system. Author

N69-20973 Texas Univ., Austin.
A THREE-DIMENSIONAL THEORETICAL MODEL FOR BASE FLOW IN MULTI-NOZZLE ROCKETS
Kazim Abbud Abbud (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-10802

The present investigation has been oriented toward the development of a three-dimensional flow model for predicting the behavior of peak base pressure in a multi-nozzle geometry over the entire flight trajectory. It has been found in the present study that reasonable results can be obtained by focusing on an isoenergetic flow within a single streamtube. The particular streamline of interest is known as the dividing streamline since it separates the flow which proceeds downstream through the shock system from that which is reversed toward the base plate. In terms of its primary components, the present flow can be described as follows. For a given nozzle exit configuration the approximate shape of the plume is found with the circular arc method of Lord. The turbulent mixing analysis of Korst is then imposed on the axisymmetric plume boundaries. Dissert. Abstr.

N69-21081*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.
APPROXIMATE CALCULATIONS OF ENGINE COST IN THE INITIAL STAGES OF PLANNING [O PRIBLIZHENNYKH RASCHETAKH SEBESTOIMOSTI DVIGATELEY NA PERVONACHALNYKH STADIYAKH PROYEKTIROVANIYA]
D. E. Starik Washington NASA Mar. 1969 19 p Transl. into ENGLISH from Tr. Soveshch. Planirovaniya i Povysheniye Effektivnosti Aviats. Proizvodstva (Moscow), no. 168, 1967 p 225–242
(Contract NASw-1692)
(NASA-TT-F-12123) Avail: CFSTI CSCL 21E

Methods are described of estimating the production costs of an aircraft engine before production has actually begun. Formulas are derived to describe the relationship of costs to the number of engines of the given model already produced and the effect of construction factors on production costs. A means of estimating engine costs from two production indices, and a method of determining the cost variations caused by modification of the engine are described. Author

N69-21105*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCALING OF A HIGH-PERFORMANCE ION THRUSTER
Eugene V. Pawlik 15 Jul. 1968 12 p refs
(Contract NAS7-100)
(NASA-CR-100431; JPL-TM-33-387) Avail: CFSTI CSCL 21C

A 20-cm diameter electron bombardment ion thruster was constructed by scaling a smaller high performance flight type unit. The scaling was not exact inasmuch as differences existed in the mercury propellant distribution, anode geometry, cathode type, and cathode location. An additional magnetic field also existed due to the spiral configuration of the cathode used. The performance of the scaled unit is presented. Ion chamber losses equivalent to those presented for the flight type thruster were obtained. Author

N69-21428# Solar, San Diego, Calif.
MECHANISMS OF SAND AND DUST EROSION IN GAS TURBINE ENGINES Quarterly Technical Progress Report, 1 Oct.–31 Dec. 1968
C. E. Smeltzer and W. A. Compton Dec. 1968 116 p refs
(Contract DAAJ02-68-C-0056)
(AD-681870; RDR-1625-2; QTPR-2) Avail: CFSTI CSCL 21/5

The subject program is designed to gain an improved understanding of the various mechanisms of dust erosion, as a basis for possible future development of turbine materials with improved innate erosion resistance. A materials science approach to the problem is emphasized, to observe, measure, and study erosion phenomena at the target surface. The object is to define working physical and mathematical models of the erosion processes, from consideration of both erosion data and phenomenological information gathered. The experimental program is organized to evaluate the relative importance of erosion influencing variables introduced by the carrier gas, the dust suspension and the target materials themselves. Two functional tasks are reported: (1) the execution of the erosion test program, including the design and construction of special test equipment; (2) the analysis of erosion data and development of physical and mathematical models to define erosion mechanisms. Author (TAB)

N69-21463*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF PLUG AND SHROUD GEOMETRY VARIABLES ON PLUG-NOZZLE PERFORMANCE AT TRANSONIC SPEEDS
Bobby L. Berrier Washington Mar. 1969 196 p refs
(NASA-TN-D-5098) Avail: CFSTI CSCL 21E

Geometry variables were plug truncation (0, 30, 72.5, and 100 percent of full length from annular throat), shroud boattail angle (8°, 20°, and 30°), and truncated plug base shape (flat and semitoroidal). All nozzle configurations were designed to operate at a jet total pressure ratio of 16.5. The ratio of annular throat area to maximum cross sectional area was 0.25. The wind tunnel Mach number was varied from 0 to 1.30. The jet total pressure ratio was varied from 1.0 to approximately 8.0 depending on the external airstream Mach number. Model angle of attack was 0° for all tests. A comparison of experimental plug pressures and theoretical plug pressures obtained by the method of characteristics is made. The performance of the 15° cone plug nozzle was shown to be higher than the performance of a comparable isentropic plug nozzle. The results also show that plug truncation decreases cone plug nozzle performance although the 15° cone plug was truncated 30 percent with a loss of generally less than 1 percent. The 72.5 and 100 percent truncated plug nozzle configurations show severe losses in nozzle performance. Increasing boattail angle generally decreased cone plug nozzle performance except for the 100 percent truncated, plug nozzle configurations. Author

N69-21476*# Wyle Labs., Inc., Huntsville, Ala.
THEORETICAL STUDIES OF COMPRESSOR NOISE
M. V. Lowson Washington NASA Mar. 1969 109 p refs
(Contract NAS1-6885)
(NASA-CR-1287; WR-68-15) Avail: CFSTI CSCL 20A

Analytical results for both sound pressure and sound power are given for four separate source mechanisms in the compressor, including rotating and stationary force and mass fluctuations. Each mechanism is modeled by a cascade of point sources, one on each blade, with appropriate phase relations between them. The results demonstrate that the rotor and stator are equally significant in the noise generation process. The leading features are the demonstration of equivalent cutoff effects without a duct, the particularly unfavorable acoustic power and directivity characteristics near to cutoff, and the favorable effects of low order modes on the sound. The principal problem in the prediction of noise is in predicting the aerodynamic characteristics of the wake flows in the compressor. A crude model for the wake flow is used to derive results which give acceptable comparison with the experiment. The effects of increasing rotor-stator and stator-rotor separation are discussed. In general it appears that the theory is in fairly good agreement with the experiment, and can therefore be used for design studies. Author

N69-21645# Council for Scientific and Industrial Research, Pretoria (South Africa)
STRAIN DUE TO AXIAL LOADING IN RESTRICTED END GRAINS IN SOLID PROPELLANT ENGINES [K DEFORMATSII SHASHEK S TORTSOVYM OGRANICHENIEM, PRIMENIAEMYKH V DVIGATELIAKH NA TVERDOM TOPLIVIE, OT OSEVYKH NAGRUZOK]
V. P. Burmistrov 1968 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 1, 1967 p 93–97
(Ref-693) Avail: Issuing Activity

Changes in the relative channel area with varying time under different axial loading conditions are analyzed. Equations are derived for determining these changes at the nozzle end of the grain during prolonged storage of the engine in a vertical position, as during accelerated flight; for the idle, second stage, of vehicle flight, where there is no pressure drop and only axial acceleration takes place; and for a grain at the working third stage. It was found that computing changes are less complex when the strength of the grain material can be described by linear viscoelastic ratios. A.C.R.

N69-21643# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
INHIBITION OF LOW TOXICITY CARBON LOOSENER (P-C-1118) PLUS SEAL Interim Report
Mary Joann Carroll Aug. 1968 32 p refs
(AD-681903; CCL-256) Avail: CFSTI CSCL 21/7

In order to reduce volume losses of carbon loosener by drag out and evaporation and to afford degreasing properties, a seal was developed while neither the carbon loosener nor the seal alone caused corrosion, together they caused gross corrosion of certain metals, especially zinc and magnesium. The purpose of this study was to alter the inhibitor system to eliminate the problem of corrosion, and a satisfactory inhibitor system was devised. Author (TAB)

N69-21648*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF A 10 DEG CONICAL TURBOJET PLUG NOZZLE WITH TRANSLATING PRIMARY AND SECONDARY SHROUDS AT MACH NUMBERS FROM 0 TO 2.0
Donald L. Bresnahan Washington Apr. 1969 34 p refs
(NASA-TM-X-1777) Avail: CFSTI CSCL 21E

Nozzle efficiencies and pumping characteristics were measured with and without external flow for a configuration employing a translating primary shroud for throat area variation. Efficiencies are compared with those of an alternate configuration employing an iris-type primary shroud. Both configurations were appropriate for an afterburning turbojet engine cycle. At subsonic speeds with the cylindrical secondary shroud retracted, the nozzles performed about the same. However, with the secondary shroud extended for operation at supersonic speeds, the translating primary provided a lower efficiency at the full-afterburning position. The pumping characteristics of the translating primary shroud were such that secondary flow could be provided to cool the primary nozzle and the shroud at all flight conditions except takeoff. Author

N69-21686# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF AN ANNULAR VAPORIZING COMBUSTION CHAMBER APPLIED TO SMALL-SIZED GAS-TURBINE ENGINES
E. P. Fedorov Jul. 1968 46 p refs Transl. into ENGLISH from Sb. Statei, Vertoletnye Gazoturbinnye Dvigateli (Moscow), 1966 p 36–71
(AD-681687; FTD-MT-24-144-68) Avail: CFSTI CSCL 21/5

In-line-flow and counter-flow annular combustion chambers were tested. A slotted model with quartz inspection windows was also used. The fuels were T-1 kerosene and B-70 gasoline (for slotted model). The models (about 16) differed in the dimensions of the vaporizing tubes and air nozzles. Analysis of the primary zone of the chamber shows the following processes: vaporization of part of the fuel and its mixing with the air in the vaporizing tubes, spreading out of the fuel-air mixture along the bottom of the fire tube with further vaporization and impoverishment of the mixture, and turbulent diffuse combustion. Author (TAB)

N69-21700# Curtiss-Wright Corp., Wood-Ridge, N. J.
ADVANCED HIGH TEMPERATURE COMBUSTOR RESEARCH FOR SMALL GAS TURBINE ENGINES Final Report
Richard H. Andersen Oct. 1968 145 p
(Contract DA-44-177-AMC-375(T))
(AD-681948; USAAVLABS-TR-68-63; REPT-68-050180-F) Avail: CFSTI CSCL 21/5

Design studies and an experimental test program were conducted to provide basic technology and preliminary flight-weight designs for a small (2-5 lb/sec total engine airflow) high temperature rise combustor with a 3000F exit temperature, as a first step towards demonstration in an advanced engine. Tests were conducted to evaluate the combustor design parameters developed in the initial design study phase of the program pertaining to liner cooling techniques, primary-diluent air mixing, fuel introduction and patternization, and primary zone performance. The preliminary designs optimize the technology developed in this program and comprise both annular and can end-mounted combustor configurations incorporating an annular vaporizer fuel introduction system and transpirationally cooled liners. Author (TAB)

N69-21816# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CONSUMPTION AND PRESSURE CHARACTERISTICS OF A DOUBLE TURBOJET ENGINE MIXING CHAMBER
E. D. Stenkin Feb. 1968 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii Aviats. Tekhn. (Kazan), v. 8, no. 2, 1965 p 115–120
(AD-682274; FTD-HT-23-1656-67) Avail: CFSTI CSCL 21/5

Mixing chamber characteristics are derived in this article. The analysis deals only with the complete mixture leaving the chamber, while the problem of partial mixture is not discussed in the present paper. The determination of the complete mixture temperature is considered. In the authors treatment, the mixing chamber is regarded as a particular case of an ejector with the characteristic developed on the basis of methods for the calculation of mixture parameters. The method proposed in the article, while specifically elaborated for a cylindrical mixing chamber can also be used with chambers having a variable cross section. TAB

N69-21869# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE FUTURE OF ROCKET ENGINES
E. S. Fridenson Jun. 1968 115 p refs Transl. into ENGLISH of the book "Buduschchee Raketnykh Dvigatelei" Moscow, 1965 p 1–110
(AD-682275; FTD-MT-24-100-68) Avail: CFSTI CSCL 21/8

The author has covered the subject of future rocket engines from the viewpoint of improvement of current models to the more distant future when basically new forms of energy will be available as power sources. Under the heading of current types, liquid, solid, and hybrid propellant engines are dealt with separately. Problems of increasing thrust, improving combustion stability, and improving reliability and control are considered in detail. The main source of

reference material is published reports of U.S. models taken from readily available sources. Only passing reference is made to any Soviet examples. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-20849*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
LOCAL TIME ASYMMETRIES IN THE INCREASE OF ELECTRON FLUXES IN THE OUTER VAN ALLEN ZONE DURING SUBSTORMS
C. S. R. Rao Feb. 1969 35 p refs
(Contract NAS5-3097; Grant NGL-16-001-002)
(NASA-CR-100419; Rept-69-8) Avail: CFSTI CSCL 04A

The increase was studied in the fluxes of electrons $E_e \geq 40$ keV and $E_e \geq 120$ keV in the outer Van Allen zone at different local times during night-time magnetic bay activity. Electrons $E_e \geq 40$ keV show increases in the midnight to afternoon sectors but not in the evening sector during bay activity. Electrons $E_e \geq 120$ keV do not, however, show significant increases at these times. Also, whereas the increase in the midnight sector occurs immediately after the onset of a bay, a significant increase in the morning sector occurs only later, i.e., during peak or recovery phase of the bay. This time delay is attributed to the time taken by the electrons that are freshly energized in the midnight sector to drift in longitude so as to appear in the morning sector. The absence of increase in the evening sector is believed due to the fact that the freshly energized electrons disappear by the time they drift to that sector. Author

N69-21069# Institut d'Aéronomie Spatiale de Belgique, Brussels.
MEASUREMENT OF SOLAR ULTRAVIOLET RADIATION BY MEANS OF STRATOSPHERIC BALLOON MESURE DU RAYONNEMENT ULTRAVIOLET SOLAIRE PAR BALLON STRATOSPHERIQUE]
M. Ackerman, D. Frimout, and R. Pastiels 1968 19 p refs In FRENCH; ENGLISH summary Presented at the Soc. Belge d'Astronomie, de Meteorol. et de Phys. du Globe, 23 Nov. 1968 /ts Aeronomica Acta A, No. A-57-1968 Submitted for publication
Avail: CFSTI

The atmospheric optical window at 2000 Å is described and measurements of the solar radiation penetrating it are represented. Author (ESRO)

N69-21077# Seimens-Schuckertwerke A. G., Erlangen (West Germany). Forschungslaboratorium.
RADIATION EFFECTS OF SOLAR FLARES ON EARTH SATELLITES AND SOLAR PROBES [STRAHLENBELASTUNG VON ERDSATELLITEN UND SONNENSONDEN DURCH DIE SOLARE KOSMISCHE STRAHLUNG (SOLAR FLARES)]
K. Wohlleben Bad Godesberg, West Germany Bundesministerium fuer Wiss. Forsch. Jan. 1969 45 p refs In GERMAN; ENGLISH summary
(BMwF-FB-W-69-01) Avail: CFSTI

An investigation was made of the radiation effects caused by solar flare protons on earth satellites and solar probes. Computer programs are described which, starting with the radiation effect at a distance of 1 AU, take into account the propagation of solar protons in interplanetary space in the case of solar probes and the shielding effect of the earth's magnetic field in the case of earth satellites. The prospective radiation effect on solar probes is calculated numerically for several years of the twentieth sunspot cycle (1965 to 1975) as well as the prospective radiation effect on an equatorial plane synchronous satellite and on the AZUR research satellite for 1968. Author

N69-21078# Siemens-Schuckertwerke A. G., Erlangen (West Germany). Forschungslaboratorium.
INTEGRATION OF THE PARTICLE FLUX DENSITIES ALONG A SATELLITE ORBIT IN THE VAN ALLEN BELT [INTEGRATION DER TEILCHENFLUSSDICHTEN AUF EINER SATELLITENBAHN IM VAN-ALLEN-STRAHLUNGSGERTEZ]
K. Wohlleben Bad Godesberg, West Germany Bundesministerium fuer Wiss. Forsch. Jan. 1969 27 p In GERMAN; ENGLISH summary
(BmWF-FB-W-69-02) Avail: CFSTI

A computer program for integrating the proton and electron flux densities to be expected in a random elliptical earth orbit within the van Allen belt is described. At first, the McIlwain's L- and B-coordinates are determined for k equidistant time steps along the orbit and then the spectra of both kinds of particles are interpolated with the known data of the spatial and energetical distribution of the trapped protons and electrons. Some computer results for the AZUR satellite are stated. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-20739 Texas Univ., Austin.
LUNAR MILLIMETER-WAVELENGTH RADIATION AND THERMAL MODEL
Dickey Eugene Clardy (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-10818

Lunar-thermal-radiation data were recorded at frequencies of 35 GHz and 94 GHz with a 16-foot diameter antenna and were used with other radiation data to determine models of the lunar surface layer. The recorded data are presented in contours of equal brightness temperature over the lunar disk at intervals of approximately twenty-four degrees of lunar phase angle. Variation of brightness temperature with time is presented in curves and in Fourier components for the selenographic center, the area around Surveyor I, Mare Tranquillitatis, Mare Imbrium, Copernicus, and the highland area around 10°W, 20°S. The derivation of an equation relating the lunar brightness temperature, surface temperature, thermal properties, and electrical properties is given from reference literature. The analyses by other experimenters of lunar brightness temperatures with this equation are discussed, and two models of the lunar surface layer are developed. Dissert. Abstr.

N69-20763 Florida Univ., Gainesville.
INFLUENCE OF IO ON JOVIAN DECAMETRIC RADIATION
Izzydor Shever (Ph.D. Thesis) 1967 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-13032

An analysis of the Jovian decametric radiation from 1957 to 1966 at three frequencies (15, 18, and 22 Mc/s) has shown the influence of Jupiter's innermost Galilean satellite, Io, on this radiation. For each year the study has reconfirmed that there are

two zenocentric intervals of Io's position in which we observe this influence. This coordinate system is centered on Jupiter and has its origin at the position of Io's superior geocentric conjunction. In the 60° to 120° interval Io enhances the probability of reception from sources B_1 and B_2, and in the 210° to 270° interval it enhances the probability of reception from sources A and C. In addition it was found that Io also influences the Jovian longitude positions of these sources. By merging the data of one frequency from all years it was found that for each source there is a distinct combination of an Io interval and an earth interval in the Jovian longitude system for which the probability of reception is enhanced by Io. Dissert. Abstr.

N69-20754 Michigan Univ., Ann Arbor.
STARS WITH STRONG CYANOGEN ABSORPTION
John Leigh Schmitt (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-13399

The properties of G8 to K4 giant stars with abnormally strong cyanogen absorption were defined. Slit spectrograms were obtained of stars that had been suspected to have strong CN absorption on objective-prism plates of the University of Michigan and the Warner and Swasey Observatory, or that were noted as having strong CN in the literature. These slit spectrograms were classified and approximately 150 strong-CN stars were found. Five groups (All G8–K2 stars, G8–K2 III-IV stars, G8–K2 moderately strong-CN stars, G8–K2 quite strong-CN stars, and K3 and K4 stars) have been formed from these stars and for each group a statistical parallax was calculated from proper motions and hence a mean visual absolute magnitude of +1.3, +1.5, +1.4, +1.3, and +1.0 respectively for the above groups. These values are somewhat fainter than those usually assumed for normal red giants. Dissert. Abstr.

N69-20755 California Inst. of Tech., Bishop.
COLOR DIFFERENCES ON THE LUNAR SURFACE
Thomas Bard McCord (Ph.D. Thesis) 1968 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-12750

Both a detailed literature survey and a new observational study were performed to determine and extend the knowledge of spectral reflectivity differences (color differences) on the lunar surface in the extended visible wavelength region. A 21-filter (0.4 μ to 0.8 μ), double beam photoelectric photometer was designed and constructed to observe differentially 83 lunar areas, some many times, to an accuracy of 0.1% to 0.3%. Some results were the discovery of: (1) many color variations up to 10% with some to about 60%, (2) a dependence of relative color on phase angle but no temporally varying luminescence, (3) broadband absorption features on spectral reflectivity curves and possibly some less broad, low amplitude (0.2% to 0.5%) humps, (4) a dependence of spectral curve shape on lunar morphology and, (5) no universal dependence of color on brightness, although some mare areas show this tendency. These results indicate that color differences are caused mainly by compositional differences and that the shapes of the spectral reflectivity curves give some indications of the rock and mineral composition of the lunar surface. Dissert. Abstr.

N69-20756 Illinois Univ., Urbana.
LEVEL POPULATIONS OF HYDROGEN AND HELIUM IN GASEOUS NEBULAE
Paul Dean Lee (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-12149

The strengths of the Balmer emission lines of hydrogen, the n^3D–2^3P series of helium, and the energy radiated in the free-bound continuum in the interval 10 Å beyond the respective series limits have been studied for the planetary nebulae NGC 6572, 7009, 7027, 7662, IC 418, 4997, and the Orion Nebula. It is shown that if the temperatures derived from [OIII] data are accepted as correct, there exists an overpopulation of the upper states of the hydrogen and helium atoms and an excess of low energy free electrons. The excess line strengths and the low temperatures determined by others from radio recombination lines are both correlated with the widths of the spectral lines. Dissert. Abstr.

N69-20758* Northrop Corp., Huntsville, Ala. Nortronics Div.
ADVANCED LAUNCH VEHICLE COMPUTER PROGRAM FOR HORIZONTAL TAKEOFF VEHICLE, THREE-DIMENSIONAL TRAJECTORIES
T. E. Perkins, J. von Puttkamer, and D. P. Conrad Mar. 1968 326 p
(Contract NAS8-20082)
(NASA-CR-98372; TR-793-8-304; TR-359) Avail: CFSTI CSCL 22C

This report documents a Horizontal Takeoff Vehicle Three-Dimensional Trajectories computer program which performs a mission analysis of a specified mission by a given horizontal takeoff vehicle operating in a three-dimensional inertial reference frame with lifting flight. Calculations of takeoff, climbout, minimum fuel profile, dynamic pressure limit flight, engine pressure limit flight, zoom, and second stage are available as desired. Targeting to the desired end velocity, altitude, and flight path angle is accomplished by an iterative calculus of variations method. Range, azimuth, fuel utilization, latitude, and longitude data throughout the mission are provided. The program is written in FORTRAN II language and is presently operational on the CDC 3200 computer. Author

N69-20772 California Univ., Berkeley.
TEMPERATURES AND CHEMICAL ABUNDANCES IN H 2 REGIONS, PLANETARY NEBULAE AND NUCLEI OF GALAXIES
Manuel Peimbert-Sierra (Ph.D. Thesis) 1967 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-10393

A photoelectric study of three H 2 regions (the Orion Nebula, M 8, and M 17), three planetary nebulae (IC 418, NGC 6572, and NGC 6803), and four galaxies (M 31, M 32, M51, and M81) has been undertaken with the Crossley and the 120" telescopes of the University of California. The effect that spatial temperature fluctuations have on electron temperatures and chemical abundances determined from H 2 regions and planetary nebulae has been studied. The Balmer Continuum was measured. From line intensities it was found that collisions by thermal electrons are not responsible for the ionization in M 81 and M 51. This result, coupled with the observed Balmer decrement in M 81, led to the adoption of radiation as the principal mechanism of ionization. Dissert. Abstr.

N69-20779*# National Aeronautics and Space Administration, Washington, D. C.
OPTIMIZATION OF TRAJECTORIES [L'OPTIMIZATION DES TRAJECTOIRES]
Pierre Contensou Apr. 1969 26 p refs Transl. into ENGLISH from Tech. et Sci. Aeron. et Spatiales (France), no. 6, 1955 p 505–513 Presented at Journees d'Etudes Spatiales de Toulouse, Toulouse, 23–28 May 1964
(NASA-TT-F-12302) Avail: CFSTI CSCL 22C

The problem of optimization of spatial trajectories is at the present time the subject of a large number of papers which involve a fairly advanced mathematical treatment. In the present report, we should like to offer some simple but precise ideas to engineers who do not specialize in the area on the manner in

which optimization problems are formulated and solved. We shall use a mode of presentation that involves a geometrical representation of the phenomena whenever possible. Author

N69-20788*# Stanford Univ., Calif. Radioscience Lab.
THE ATMOSPHERE OF VENUS AS STUDIED WITH THE MARINER 5 DUAL RADIO-FREQUENCY OCCULTATION EXPERIMENT, PART 1 Final Report
G. Fjeldbo and V. R. Eshleman Jan. 1969 39 p refs
(Grant NGR-05-020-276)
(NASA-CR-100416; SU-SEL-69-003) Avail: CFSTI CSCL 03B

The amplitudes and differential doppler of two radio signals transmitted to Mariner 5 as it was occulted by Venus are utilized to derive the day and night-side ionization distributions in the upper atmosphere and the temperature and pressure profiles of the lower atmosphere. Both sides of Venus have ionization peaks near the 140-km altitude level; the daytime peak is 30 times greater in electron number density. The night-side ionosphere extended up to an altitude of at least 1000 km, and the day-side ionization terminated in a plasmapause near a 500-km altitude. The neutral atmosphere was probed down to within 35 km of the planetary surface. Author

N69-20807 Colorado Univ., Boulder.
SOLAR EXTREME LIMB SPECTRUM OF THE RARE EARTH CERIUM
Richard Charles Canfield (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-12392

Observations and theoretical calculations of rare earth lines demonstrate that non-coherent scattering quantitatively explains the observed behavior of these lines. Photographic and photoelectric observations were made with 160 cm aperture and 90 m focal length McMath solar telescope, covering the solar disk from its center to beyond the limb. Double-pass spectroscopy permitted accurate correction for spectrograph scattered light. Strong evidence demonstrated that of all available mechanisms for explaining the behavior of the rare earth lines in the solar spectrum, only a considerable contribution from non-coherent scattering can explain the observed phenomena in terms of the currently understood properties of radiation transfer and the solar atmosphere. Dissert. Abstr.

N69-20808 California Inst. of Tech., Pasadena.
THE KINETIC THEORY OF THE SOLAR WIND AND ITS INTERACTION WITH THE MOON
David Henry Griffel (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-12740

Effects of interactions of the wind and moon are studied by means of the Boltzmann equation. The interaction of the wind with the moon is treated as solid body, with neither magnetic field nor atmosphere, absorbing and neutralizing all incident particles. An exact theory is constructed of the boundary layer between such a body and a plasma with a magnetic field parallel to the surface, valid when the plasma has no velocity towards the surface. Two-dimensional models of the complete wind-planet interaction are considered and show that in any steady two-dimensional flow, the plasma velocity must be tangential to the body. Then, using the model of the sheath it is shown that there can be no steady flow at all around a finitely conducting cylinder. The magnetic fields induced by the interplanetary field inside the moon are considered taking account of its rotation. Dissert. Abstr.

N69-20809 Colorado Univ., Boulder.
THE THERMAL EMISSION OF INTERPLANETARY DUST CLOUD MODELS
Christopher Barina Kaiser (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-12409

A model of the interplanetary dust cloud is constructed and the thermal emission of this model is computed. The temperature and number density of the dust particles as functions of their size and distance from the sun are derived involving a thorough study of the optics and thermodynamics of the particles and their evolution in time. The thermal emission of the model for various size distributions is computed and peaks are found in the emission intensity at the edges of the two dust-free zones. Dissert. Abstr.

N69-20810*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL THREE DIMENSIONAL LAUNCH VEHICLE TRAJECTORIES WITH ATTITUDE AND ATTITUDE RATE CONSTRAINTS
Fred Teren and Omer F. Spurlock Washington Mar. 1969 48 p refs
(NASA-TN-D-5117) Avail: CFSTI CSCL 22C

Equations are derived for maximizing payload capability for nonplaner boost trajectories arising from range safety considerations. The assumed range safety constraints are satisfied by requiring a fixed vehicle azimuth heading during the initial part of the trajectory. This azimuth (attitude) constraint is removed as soon as certain land areas have been avoided. An attitude rate limit is also imposed to prevent discontinuous attitude changes. The calculus of variations is used to formulate and solve the mathematical problem. A simplified method is also presented for obtaining the auxiliary variational terminal conditions associated with free end conditions. Sample results are presented for sun-synchronous and planetary missions. Author

N69-20813*# Stanford Univ., Calif. Radioscience Lab.
THE REFRACTIVITY OF CO_2 UNDER SIMULATED MARTIAN CONDITIONS
G. Leonard Tyler and H. Taylor Howard Mar. 1969 22 p refs
(Grant NGL-05-020-014)
(NASA-CR-100418; SU-SEL-69-013; SR-33) Avail: CFSTI CSCL 03B

In the temperature range of 150 to 190°K, at pressures from 2 to 25 millibars, the refractivity per molecule per cm^3 is $1.78 \times 10^{-17} \pm 0.06$ when scaled by the ideal gas law. The measurements include pressures and temperatures which are within 3°C of the sublimation curve. This result is slightly lower than the best measurements previously obtained near standard temperature and pressure at other frequencies ($1.8345 \times 10^{-17} \pm 0.0003$) and at 2.26 gHz under standard conditions by the authors ($1.8413 \times 10^{-17} \pm 0.005$). It is concluded that the scaled refractivity of CO_2 in the range of temperatures and pressures stated above may be a few percent lower than under standard conditions. These results do not significantly alter the conclusions regarding the atmosphere of Mars as measured by the radio occultation method. Author

N69-20815# Royal Aircraft Establishment, Farnborough (England).
THE DYNAMICS OF LOW-THRUST SPACECRAFT MANOEUVRES
E. G. C. Burt May 1968 51 p refs Presented at the 11th Roy. Aeron. Soc. Lanchester Mem. Lecture, London, 9 May 1968
Copyright. Avail: CFSTI
(RAE-TR-68120) Avail: CFSTI

Orbital manoeuvres by means of impulsive thrusts, such as those available with chemical rockets, are well known, but a

different treatment is needed for the small, continuous thrusts which are typical of electrical propulsion systems. It is shown that with the aid of these small forces it is possible to change independently all the orbital elements of a spacecraft, and thus to proceed slowly from a given orbit to any other. For each manoeuvre there exists an equivalent velocity which depends only on the initial and final orbital states, and which can be related directly to the spacecraft propulsion parameters. For any form of propulsion where the expellent acquires some or all of its energy from a separate energy source, as in electrical propulsion, it is found that optimum time-varying relations exist between the flow of mass and of energy, which may also be expressed in terms of the exhaust velocity and the thrust. In particular, the optimum exhaust velocity is shown to be an increasing function of time, related to the way in which the energy is released. The practical realization of electrical propulsion depends on the development of efficient propulsion units and of light-weight power supplies; these and other spacecraft components are discussed, and a number of examples of orbital manoeuvres are given, including close-Earth, far-Earth and lunar orbits. The paper concludes with a discussion of these orbital transfers in relation to their possible uses, including communication satellites and a test of relativity theory. Author (ESRO)

N69-20827 Case Western Reserve Univ., Cleveland, Ohio.
PHOTOMETRIC AND SPECTRAL VARIATIONS OF GIANT M STARS
Nancy Mia Houk (Ph.D. Thesis) 1967 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-10164

Spectral changes with phase of 121 long-period variables of type M in Groningen-Palomar Field 2 (l^{II} = 4°, b^{II} = 12°) are studied, using objective-prism plates and the infrared region for classification. Spectral types for each star are determined at from 7 to 18 distinct epochs. Variables having photographic magnitude ranges of 2 or 3 magnitude or more show spectral changes of several subtypes in the course of their light cycle, the earliest spectral type occurring at photometric maximum, and all the variables reaching type M6.5 or later at minimum. Periods are determined for about 60 variables, and spectral subtype is plotted against phase for 39 larger-amplitude variables. Period-spectrum relations for maximum and minimum spectral types are roughly parallel and separated by about four spectral subtypes. Dissert. Abstr.

N69-20894 Michigan Univ., Ann Arbor.
THE CALCULATION OF LONG-WAVE RADIATIVE TRANSFER IN PLANETARY ATMOSPHERES
Sydney Roland Drayson 1967 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-7586

A method is developed for calculating long-wave radiative transfer in a plane parallel atmosphere. Two applications involving the 15 μ bands of CO_2 are given, the first to the earth's mesosphere and lower thermosphere, taking vibrational relaxation into account and the second to the Martian atmosphere, for use in a simple atmospheric circulation model. In this study atmospheric radiative fluxes and flux divergences are obtained by direct integration with respect to frequency across the absorption bands. The atmosphere is divided into horizontal layers which may be made arbitrarily thin. The direct integration method allows the Curtis–Godson approximation to be applied over successive thin layers, rather than thick atmospheric layers. Dissert. Abstr.

N69-20904 Indiana Univ., Bloomington.
V448 CYGNI AND V453 CYGNI: TWO ECLIPSING BINARIES IN THE P CYGNI REGION
Howard Lionel Cohen (Ph.D. Thesis) 1968 247 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-11399

Photoelectric UBV light curves of the double-line spectroscopic binaries V448 Cygni and V453 Cygni are studied. The light curve of V448 Cygni is type EB, shows complete eclipses, large asymmetries and other vagaries. The color changes confirm the difference in spectral types but the components do not seem equally bright. The type EA light curves of V453 Cygni appear relatively free of complications. Although there are no color changes, a slight difference in surface brightness is indicated. The system appears to be composed of two detached B 0.5 IV stars with an orbital eccentricity of 0.01. It is concluded that the absolute dimensions of V448 Cygni cannot be regarded as genuine, but V453 Cygni seems capable of providing reliable data. Dissert. Abstr.

N69-20908 Colorado Univ., Boulder.
A STUDY OF NEUTRAL ATOMIC OXYGEN IN THE SOLAR ATMOSPHERE
Richard Charles Altrock (Ph.D. Thesis) 1968 272 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.50 Order No. 68-12387

Possible departures from local thermodynamic equilibrium (LTE) in photospheric oxygen are investigated and an abundance for that element is derived. The observations were obtained with the 16-inch Coudë coronograph and the 13-meter Littrow spectrograph. The raw data, consisting of photoelectric wavelength scans of seven oxygen multiplets, were corrected for scattered light, dark current and instrumental effects. Restoration of line profiles was carried out utilizing five iterations of a modified method in which the differences between the observed and predicted profiles were smoothed. Noise filtering was accomplished by convoluting the observed data. The results are consistent with the assumption that all levels of oxygen in the photosphere are populated as in LTE. Dissert. Abstr.

N69-20916*# National Aeronautics and Space Administration, Washington, D. C.
MODELS OF VENUS ATMOSPHERE, 1968
Robert A. Schiffer (JPL) and Andrew J. Beck (JPL) Dec. 1968 32 p refs
(NASA-SP-8011) Avail: CFSTI CSCL 03B

This monograph provides a set of engineering models of the Venus atmosphere, based on theory and data. In preparing these models, an assessment was made of the effects which planetary atmospheric characteristics might have on the performance of the space vehicle and its major subsystems. These characteristics include the structure, composition, and dynamics of the atmosphere, which can have both aerodynamic and thermal effects on the space vehicle. Of these atmospheric variables, the vertical distribution of mass density is regarded as the most critical parameter for design functions which involve aerodynamic effects. However, chemical composition and temperature structure also require definition because they affect density and thermal calculations. In addition, the viscosity, specific heats, and speed of sound influence vehicle aerothermodynamic analyses; and atmospheric winds affect entry dynamics for terminal descent. Finally, the atmospheric aerosol content and opacity constrain the design of landed solar power systems and influence performance of communications equipment. Author

N69-20921 California Inst. of Tech., Pasadena.
DYNAMICS OF A COLLAPSING PROTOSTAR
Richard Bondo Larson (Ph.D. Thesis) 1968 267 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.45 Order No. 68-13070

Numerical calculations of the dynamics of a spherically symmetric collapsing protostar have been made for various assumed initial conditions. In all cases the collapse is found to be extremely nonhomologous, the density distribution becoming more and more sharply peaked at the center as the collapse proceeds. As a result, a very small part of the cloud's mass at the center reaches stellar densities and temperatures and stops collapsing before most of the cloud has had time to collapse very far. The central stellar core thus formed subsequently grows in mass as the surrounding material falls into it, finally becoming an ordinary star when all of the original protostellar material has been accreted. During most of this time the forming star is completely obscured by the dust in the infalling cloud, the absorbed radiation reappearing in the infrared as thermal emission from the dust grains. Dissert. Abstr.

N69-20925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE FIGURE OF MERCURY
Han-Shou Liu May 1968 11 p refs
(NASA-TM-X-63487; X-643-68-306) Avail: CFSTI CSCL 03B

The figure of Mercury is estimated in terms of an isostatic form of equilibrium which tends to be controlled by the situation near perihelion passage at the 3:2 resonance spin rate. The ratios of the principal moments of inertia for Mercury are: (1) $(C-A)/C \geq 7 \times 10^{-5}$; (2) $(C-B)/C \geq 10^{-5}$ and (3) $(B-A)/C \geq 10^{-5}$. The thermal effect on Mercury's figure during solidification forces the planet's rotation to be trapped in the 3:2 resonance lock as its spin rate is being slowed by tidal effects. It is shown that the process of trapping of Mercury has been naturally affected by the instantaneous solidification of the planet into a shape with two thermal bulges, and that the two permanent thermal bulges stabilize the planet's rotation. Author

N69-20930 California Univ., San Diego.
A SEARCH FOR GAMMA-RAY LINE EMISSIONS FROM THE CRAB NEBULA
Allan Stanley Jacobson (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-11594

An X-ray telescope was designed, incorporating one of the newly developed lithium-ion drifted germanium crystals as the main detector. This instrument, which has better energy resolution properties than any detector operated previously in the energy range of 20 to 250 keV, was used to study the spectrum of the Crab Nebula, and particularly to search for any fine spectral features such as line structures. The detector, with an area of 9.2 cm^2 and a solid angle of .077 steradians, was surrounded by a CsI(Tl) scintillation shield connected in electrical anti-coincidence. The telescope was carried to an altitude of about 129,000 feet (3.2 gm/cm^2) by a 6 million cubic foot balloon launched at 0540 CDST on July 23, 1967, from Palestine, Texas ($\lambda = 41°$). The Crab Nebula transitted through the telescope aperture at 1118 CDST, at which time the counting rates increased by some 60%. Telemetered to ground stations located at Palestine and El Paso, the data was recorded on magnetic tape for subsequent play-back and decoding. Dissert. Abstr.

N69-20948 Michigan Univ., Ann Arbor.
A MODEL FOR THE EXPLOSION IN M82
Alan Benjamin Solinger (Ph.D. Thesis) 1968 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-13407

Analysis of the relevant radio and optical data shows that a synchrotron interpretation of the polarized optical continuum observed at large distances from the center of M82 should be ruled out. It is shown that the $H\alpha$ emission from the filaments is collisionally excited, and that a blast-wave interpretation of the explosion provides a suitable heating mechanism. The observed circular orientation of the electric vectors of the polarized light can be produced by scattering of light from the proposed Seyfert-like nucleus (located at the center of the explosion) by free electrons behind the shock front. Self-similar solutions to the equations of hydrodynamics for an explosion in an ambient medium with a power-law varying density provide a basis for predicting the polarized flux observed. It is concluded that M82 should be regarded as a Seyfert galaxy, seen edge-on. Dissert. Abstr.

N69-20963 Texas Univ., Austin.
THE DYNAMICAL EVOLUTION OF TRIPLE-STAR SYSTEMS
Robert Sutton Harrington (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-10843

Triple stars can be described dynamically by orbits that have arbitrary eccentricities and mutual inclinations but for which the ratio of semi-major axes is a small quantity of the order of 0.1. For a wide range of systems, the components can be considered point masses, and the drag from interstellar medium and galactic tidal forces can be neglected. The short period effects are determined and eliminated from the Hamiltonian by two applications of the von Zeipel averaging technique, the Hamiltonian being determined through the third order and the determining functions through the second order. Triple star orbits are dynamically stable, unless the orbits are perpendicular, since the semi-major axes have no secular variations. Dissert. Abstr.

N69-20969 Johns Hopkins Univ., Baltimore, Md.
INFRARED OBSERVATIONS OF THE OUTER SOLAR CORONA
Robert Moffat MacQueen (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-10573

The 2.2μ wavelength infrared outer solar corona has been observed in two experiments: first, employing a ground-based telescope from a high altitude site near Pulacayo, Bolivia, during the 93 second totality of the eclipse of 12 November 1966; and second, employing a stratospheric balloon package with an infrared coronagraph flown to an altitude of 28 km, during a 5.25 hour period, on 9 January 1967. The design and evaluation of the infrared balloon-borne coronagraph is discussed in detail, and the various origins of stray light investigated. The completed flight coronagraph was found to introduce a stray radiance of less than $3 \times 10\ 10^{-12} B_{\odot}$, where $B_{\odot}$ is the radiance of the mean solar disk at wavelength 2.2μ. During eclipse the corona was observed from $2R_{\odot}$ to $6R_{\odot}$ in the ecliptic plane, and at a single point perpendicular to the ecliptic at $5R_{\odot}$. Balloon observations covered the range $3.7R_{\odot}$ to $10R_{\odot}$, at position angles from 20° north to 40° south of the ecliptic, on the east limb of the sun. Dissert. Abstr.

N69-21018*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF GRAVITATIONAL-MODEL SELECTION ON ACCURACY OF LUNAR ORBIT DETERMINATION FROM SHORT DATA ARCS
Harold A. Hamer and Katherine G. Johnson Washington Mar. 1969 40 p refs
(NASA-TN-D-5105) Avail: CFSTI CSCL 22C

The purpose of the present report is to give an insight into the accuracy of lunar orbit determination which may be expected with gravitational models having relatively few coefficients. The gravitational models investigated included the spherical harmonics through the fourth order. The results of the analysis were obtained by fitting tracking data from Lunar Orbiter Missions I and III. Relatively short data arcs of a few orbital periods were used

in determining the orbit. For the most part, the JPL program was used for the data fits; additional results are presented in which up to 21 coefficients were determined from the Lungfish (lunar gravitational field in spherical harmonics) orbit-determination program. The orbit-determination accuracy was analyzed by studying the effects of varying the gravitational model and the length of the data arc. In certain cases the gravitational coefficients were solved for and in others the coefficients were held fixed at predetermined values. Various criteria used to compare the cases included results from the fitted data arc as well as data predicted ahead of this arc. Author

N69-21019* Northrop Corp., Huntsville, Ala. Nortronics Div.
ADVANCED LAUNCH VEHICLE COMPUTER PROGRAMS FOR VERTICAL TAKEOFF TRAJECTORIES, HORIZONTAL TAKEOFF TRAJECTORIES, AND HORIZONTAL TAKEOFF TRAJECTORIES WITH SONIC BOOM CALCULATION, SUPPLEMENT
D. P. Conrad Mar. 1968 157 p ref
(Contract NAS8-20082)
(NASA-CR-98370; TR-793-B-110S; TR-361) Avail: CFSTI CSCL 22C

Additions and improvements made to both the Vertical Takeoff Program (VTO) and the Horizontal Takeoff Program (HTO) are presented and discussed, including the addition of several calculation options, output options, input changes, and general program streamlining. These changes necessitated converting the HTO from the SDS 930 to the CDC 3200, and setting up two decks for the VTO: a skeletal one on the SDS 930, and in all option version for the CDC 3200. In addition, sketches of the vehicles for which these programs were written have been included. Author

N69-21034 Indiana Univ., Bloomington.
THEORETICAL SUNSPOT MODELS
Hong Sik Yun (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-11429

Thirty-two theoretical sunspot models were computed using as parameters the effective temperature, total magnetic flux, and angle of inclination at the outer edge of the penumbra. The physical properties of each model were discussed and compared with the observation to select the models which represent the observations best. In computing the magnetic field in the spots, the magnetostatic theory of sunspots was applied. In computing the gas pressure and temperature in the spots, the diffusion approximation was used in the radiative region and Vitense's procedure in the convective zone. On the basis of the observed relations, the theoretical models were compared with the observations and the results of the comparisons were discussed. It was found that the computed models represented the observations within the range of the observational uncertainty. Dissert. Abstr.

N69-21037 Royal Observatory, Edinburgh (Scotland).
THREE-COLOUR PHOTOMETRY OF SOUTHERN GALACTIC CLUSTERS. 4: NGC 5822, 5823
M. T. Brueck, M. J. Smyth, and A. McLachlan 1968 16 p refs
Its Publ. Vol. 6, No. 9
Copyright. Avail: HMSO 6s 6d

Photoelectric and photographic UBV photometry, to V = 14, is carried out for 166 stars in NGC 5822 and and 107 stars in NGC 5823. There is moderate reddening. NGC 5822 has a pronounced giant branch. The distances of the clusters, with their estimated limits of uncertainty, are 720 ± 50 pc and 680 ± 160 pc. The clusters may thus form a double system with a mean distance of 700 pc, diameters of 8 pc and 4 pc, separation 15 pc, and a common age of about 2×10^8 years. Author

N69-21040*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENTRY DYNAMICS OF A SPINNING VEHICLE
Robert H. Prislin and Peter Jaffe 15 Aug. 1968 13 p refs
(Contract NAS7-100)
(NASA-CR-100430; JPL-TM-33-398) Avail: CFSTI CSCL 22C

A closed-form solution for the angular motion of a spinning atmospheric entry vehicle has been developed. The influence and interaction of the density gradient, the spin, the initial angles and angular rates at entry, and the aerodynamics of the vehicle are demonstrated by the solution. The effect of adding spin is to attenuate the influence of the dynamic pressure gradient and to amplify the importance of dynamic stability near, and after, peak deceleration. An important conclusion is that a spinning entry body with zero or small transverse angular velocity will exhibit damped circular motion. In addition, when the motion is nearly circular, the small angle-of-attack restriction implicit in the development of the equation is relaxed, extending the region of applicability to high angles of attack. Several examples are presented and comparisons were made with six-degree-of-freedom calculations of the amplitude history; in all cases, the agreement was better than 5%. Author

N69-21051*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
VARIATIONS IN ORBITAL ALTITUDE ATMOSPHERIC DENSITY FOR MSFC 1971–1976 SPACE STATION PROGRAMS
Don K. Weidner, G. S. West, and G. R. Swenson 13 Feb. 1969 147 p refs
(NASA-TM-X-53815; X-53815) Avail: CFSTI CSCL 22A

Provided are predictions of the mean orbital atmospheric density to which an orbiting space station will be exposed on particular days at intervals of 3 months from January 1, 1971 through January 1, 1977. When used along with the presented atmospheric variability information, these predictions will enable the user to determine the design limits for a particular engineering or scientific operational requirement on the space station during the 1971 through 1976 time period. Atmospheric structure and variability and data acquisition techniques are briefly described to provide a general understanding of the accuracy and limitations of the current orbital altitude atmospheric models. In addition to predictions of the mean orbital atmospheric density, values for pressure, temperature, and molecular weight are also given. Author

N69-21062*# Eastman Kodak Co., Rochester, N. Y. Apparatus Div.
LUNAR PHOTO STUDY, PHASE 4 Final Report, 30 Nov. 1967–30 Nov. 1968
J. B. Hustler and T. J. Lauroesch 14 Mar. 1969 228 p refs
(Contract NAS9-7825)
(NASA-CR-99601) Avail: CFSTI CSCL 22A

A realistic 10' × 10' lunar model was made at a scale of about 1:50 to represent a portion of a potential landing site in Sinus Medii. Construction was based on a contour map of the area furnished by NASA. The visual appearance of the moon was achieved by dusting with cupric oxide and lighting with a source simulating the sun. Motion pictures of this model were made to simulate a portion of the view from a LM window during one of the final minutes of a landing. The motion picture sequences showed two basic approaches to landing: a straight-in approach along a 14° incline to a primary site and a dogleg maneuver to a secondary site. A motion picture was made for each trajectory for sun elevations of 5° and 12°; when projected at 24 frames/sec, these motion pictures show events in real time. Still photographs were made at seven selected positions along the trajectory during the filming of the motion pictures for the straight-in approach. It was concluded that the optimum sun elevation for a photographic

mapping mission depends on the average slope of the terrain being mapped and the accuracy desired. In general rugged terrain should be mapped at higher sun elevations. Author

N69-21113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL LUNAR EPHEMERIS NUMBER 6
J. Derral Mulholland 15 Oct. 1968 27 p refs
(Contract NAS7-100)
(NASA-CR-100492; JPL-TM-33-408) Copyright. Avail: CFSTI CSCL 03C

A revised lunar ephemeris has been constructed by applying a further correction to JPL Lunar Ephemeris Number 4 (LE 4). This correction completes the process of introducing all of the accessible theoretical corrections to the Brown Lunar Theory. It consists of the application of series terms, based on work by G.W. Hill, to adjust the coordinates to be compatible with the modern value of the earth's dynamical form factor J_2. The correction expressions are given and their application discussed. The accuracy of LE 6 estimated, based on experience with LE 4 and on subsequent ephemeris improvement efforts. Author

N69-21114*# Boeing Co., Seattle, Wash.
LUNAR ORBITER PHOTO SITE ACCURACY ANALYSIS. PART 1: PHOTO SITE ANALYSIS Final Report
T. J. Hansen [1968] 63 p refs
(Contract NAS1-7954)
(NASA-CR-66734-1; D2-100814-1) Avail: CFSTI CSCL 22A

Analyses have been performed to improve the knowledge of the selenographic location of photographs taken on the five Lunar Orbiter missions. All technical areas affecting the computation of photo site locations have been re-examined, including spacecraft performance, orbit determination and the celestial environment. A checkpoint location technique was developed to measure consistency and accuracy of the results. As a result, the prime site photo location accuracy has improved from about 2.5 km to less than 1 km discrepancy. Revised attitude maneuvers, camera geometry, exposure times and state vectors were produced with improved techniques and used to generate a new set of Lunar Orbiter photo location documents. Author

N69-21115*# Boeing Co., Seattle, Wash.
LUNAR ORBITER PHOTO SITE ACCURACY ANALYSIS. PART 2: SUPPORTING DATA Final Report
T. J. Hansen [1968] 449 p refs
(Contract NAS1-7954)
(NASA-CR-66734-2; D2-100814-2) Avail: CFSTI CSCL 22A

The input data for improved photo location calculations are presented under the analysis categories (attitude maneuvers, exposure times, lunar radii, camera field of view, and state vectors). They were used to produce the replacements to the Postmission Photo Supporting Data documents for each Lunar Orbiter flight. Author

N69-21116* Boeing Co., Seattle, Wash.
LUNAR ORBITER PHOTO SITE ACCURACY ANALYSIS. PART 3: ERROR ANALYSIS Final Report
John P. Dyer [1968] 646 p refs
(Contract NAS1-7954)
(NASA-CR-66734-3; D2-100814-3) Avail: CFSTI CSCL 22A

A selenographic error analysis was performed for representative photographs taken on all five Lunar Orbiter missions. Nine points within each photograph were analyzed; contributions to the total error are made by navigation, spacecraft attitude, camera on-time, and lunar radius errors. Author

N69-21196 Case Western Reserve Univ., Cleveland, Ohio.
CHANGES IN THE NEAR INFRARED SPECTRA OF FIFTY-ONE RED VARIABLE STARS
Chris L. Terrill (Ph.D. Thesis) 1967 91 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-10188

Objective prism spectra in the near infrared (6800–8900Å) were used to follow the spectral variations of fifty-one Mira, semiregular, and irregular variable stars with their changes in brightness. Thirty-one of the variables are of spectral type M, nineteen of spectral type S, and one, R CMi, is a weak carbon star. Diagrams are presented showing the M-type spectral variations with phase for twenty-three Mira or SRa type variables which are well observed. The variations in M spectral type are found to correlate well with changes in brightness of the variables with phase. The range of spectral variation is greater for variables of greater light amplitude. Dissert. Abstr.

N69-21197 Case Western Research Univ., Cleveland, Ohio.
SPECTROSCOPIC STUDY OF COOL STARS IN THE NEAR INFRARED
Susan Wyckoff (Ph.D. Thesis) 1967 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-10194

Low dispersion near infrared slit spectra of a sample of M, S and carbon stars have been examined. It has been found that the spectral types of 17 M type long-period variables observed near minimum light define a period-spectrum relation which parallels, at ≈3 sub-types later, the analogous relation for types at maximum light. Changes in molecular band strengths as a function of phase in the spectra of several stars reaffirm the temperature changes in M and S long-period variables. Four unidentified infrared bands first found by Keenan probably characterize the cooler S stars with high Zr/Ti abundance ratios. Infrared spectra of R Cyg indicate the four bands are quite sensitive to phase in the light cycle. A small sample of carbon stars has been classified according to criteria in the visual spectral region. Dissert. Abstr.

N69-21212 Case Western Reserve Univ., Cleveland, Ohio.
THE STRUCTURE AND PROPERTIES OF H 2 REGIONS
Robert Howard Rubin (Ph.D. Thesis) 1967 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-10179

The equations of ionization and thermal equilibrium were solved for gaseous nebulae, allowing for an arbitrary density distribution. It was shown, by solving the transfer equation for the ionizing radiation produced by recombinations, that use of the "on-the-spot" approximation can cause considerable errors in the temperature structure and predicted emission properties. Changes in the gas structure due to variations of the model parameters were investigated. For the models calculated, the emission properties of the important lines were presented. Temperature structures inferred from various forbidden line ratios of surface brightness, obtained from a model, were significantly different from each other and from the actual temperature structure. Dissert. Abstr.

N69-21268# Joint Publications Research Service, Washington, D. C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 199 28 Feb. 1969 p 1–7 refs (See N69-21267 10-13)
Avail: CFSTI

Brief reports are given on the Soviet balloon-raised solar observatory and on recent research and conclusions regarding the origin of meteorites and the age of the solar system. Abstracts of

recent Soviet publications are presented in the following areas: satellite perturbations during motion about an axisymmetric planet, apparatus for registry of star transit time, motion of artificial lunar satellites, magnetic pellets of cosmic origin, a method of calculating atmospheric extinction, uranium cosmochronology, precise measurements of radial velocities, seasonal variations of telluric lines, elliptical polarization of solar radio bursts, and shock waves causing solar radio bursts. Bibliographic information accompanies each abstract. P.A.B.

N69-21283*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A BRIEF SURVEY OF THE MAJOR PLANETS: JUPITER, SATURN, URANUS, AND NEPTUNE
R. L. Newburn, Jr. 1 Apr. 1969 38 p refs
(Contract NAS7-100)
(NASA-CR-100471; JPL-TM-33-424) Copyright. Avail: CFSTI CSCL 03B

The best available numerical values are given for physical parameters, including orbital and body properties, atmospheric composition and structure, and photometric parameters. The more acceptable current theories of these bodies are outlined with thorough referencing offering access to the details. The survey attempts to be complete through November 1, 1968. Author

N69-21292*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF INTERPLANETARY TRAJECTORIES
H. F. Lesh 1 Nov. 1968 74 p
(Contract NAS7-100)
(NASA-CR-100490; JPL-TM-33-414) Copyright. Avail: CFSTI CSCL 22C

This document presents in the simplest possible language the fundamental ideas involved in calculating the flight paths of lunar and planetary spacecraft. The mathematics are kept relatively simple and complex ideas are clarified by the use of diagrams. The paper will be useful to the technically educated person who wants to understand basic trajectory theory. Author

N69-21302 Royal Observatory, Edinburgh (Scotland).
PHOTOGRAPHIC MEASURES OF THE POLARIZATION OF STARLIGHT IN h AND χ PERSEI
N. M. Pratt 1968 87 p refs *Its* Publ. Vol. 6, No. 4
Copyright. Avail: HMSO £1 4s

A new photographic method is described for measuring the polarization of starlight using a polaroid filter which allows the simultaneous measurement of brightness differences not due to polarization effects. Overlapping of star images limits the use of the method to areas of sky with $\leq 6 \times 10^3$ stars per square degree. 527 stars in h and χ Persei to V ≈ 13 have been measured. Using the Stokes parameters, comparison with published photoelectric measures for 54 stars gives an r.m.s. deviation of ± 0^m.029 per star, and the photoelectric and photographic means agree to within 0^m.003 and 1°. Stars with large proper motions have a smaller amount of polarization, and stars with V > 12 have a larger amount of polarization, but the position angle scarcely varies. Author

N69-21314# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
INTEGRALS FOR IMPULSIVE ORBIT TRANSFER FROM NOETHER'S THEOREM
H. Gardner Moyer Mar. 1969 23 p refs Submitted for publication
(RE-383J) Avail: Issuing Activity

The problem considered is the minimum impulse transfer of a vehicle between noncoplanar Kepler orbits. The transfer time, the number of impulses, and the points of departure and arrival on the terminal orbits are all unspecified. The principles of optimal control are applied to the formulation with orbital elements as state variables and characteristic velocity as the independent variable. Three constants of the motion, composed of state variables and Lagrange multipliers, are obtained in general form by means of Noether's theorem. The special form of these integrals that has been previously published is confirmed. The constants are shown to be the components of a vector in physical space. There is not a total of five integrals for the tenth order system. Author

N69-21348# European Space Operations Center, Darmstadt (West Germany).
LUNI-SOLAR PERTURBATIONS OF A HIGHLY ECCENTRIC ORBIT SATELLITE
E. A. Roth Paris ESRO Apr. 1968 58 p refs
(ESRO-SR-9-ESOC) Avail: CFSTI

The luni-solar perturbations on a satellite with a highly eccentric, non equatorial orbit are investigated using the approach of Lidov (1961). His method of averaging is somewhat simplified and the expansion is carried out to the third (P_4) term in the development of the disturbing function. Moreover, an equation for the perturbation of the time of revolution is added. The first and second time derivatives of the motion of the disturbing body are included in this theory. Author (ESRO)

N69-21382# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A THEORY FOR THE ORIGIN OF MATTER AND GALAXIES
R. Omnes Jan. 1969 42 p refs
(Rept-69/2) Avail: CFSTI

The properties of the black-body radiation at high temperatures (400 MeV > kT > 100 MeV) where the strong interactions play an important role, particularly between pions, nucleons and antinucleons are investigated. With the help of the static model, the existence of two very remarkable effects are established: (1) local non-zero densities of isotopic spin develop for kT > 210 MeV, (2) local non-zero densities of baryonic charge occur for kT > 270 MeV. The second effect has important consequences for cosmology: in an expanding universe with zero total baryonic charge, it gives rise during the initial stages to a condensation of matter and antimatter in small separate regions of space. It is shown that these early condensations are not completely destroyed in the subsequent evolution but leave at the present time a remaining density of matter which can be computed and agrees remarkably well with the observed value in our Universe. Author

N69-21457# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NUMBER 200
11 Mar. 1969 49 p Transl. into ENGLISH from Russian sources
(JPRS-47616) Avail: CFSTI

Abstracts, summaries, and articles are given on materials gathered from publications of various Soviet countries. Subjects discussed are astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and space research. Complete bibliographic information accompanies each article. B.G.D.

N69-21505 Royal Greenwich Observatory, Herstmonceux (England).
THE RADIAL VELOCITIES, SPECTRAL TYPES AND PROJECTED ROTATIONAL VELOCITIES OF 633 BRIGHT NORTHERN A STARS

D. R. Palmer, E. N. Walker, D. H. P. Jones, and R. E. Wallis London, HMSO 1968 73 p refs Prepared jointly with Royal Obs., Capetown (South Africa) /*ts* Bull. No. 135
Copyright. Avail: HMSO 10s

Approximately six plates of each of six hundred and thirty-three stars, north of the Equator and with HD types B9-A5, were obtained. All stars with unknown or poorly determined radial velocity, brighter than $m_v = 6.3$, were included and also some fainter ones. A selection of stars with well determined velocity was also included, together with a majority of the appropriate standard stars of the MK spectral classification system. The material has been completely reduced for radial velocity, and visual estimates of spectral type and v sin i were made in all the plates. For a typical star these parameters have standard errors in the mean of ±4 km/s in radial velocity, ±1 spectral sub-type and ±30 km/s in v sin i. Author

N69-21508*# California Inst. of Tech., Pasadena.
STABLE CRACK PROPAGATION IN A VISCOELASTIC STRIP
Hans-Karl Mueller (Ph.D. Thesis) Washington NASA Mar. 1969 145 p refs
(Grant NsG-172-60)
(NASA-CR-1279) Avail: CFSTI CSCL 20K

A crack of given length propagating with small, constant speed through a viscoelastic strip is considered. The strip is strained by displacing its shearfree edges. Linear theory is applied. The stress on the line of crack advancement and the shape of the crack surface are calculated for a state of plane stress. The energy which is released when the crack extends a small distance is calculated. This crack energy depends on the crack speed and involves the creep function of the material. A characteristic length enters in the course of its derivation. This length does not appear in the case of an elastic material and is considered as an additional material property necessary to describe visco-elastic crack propagation. The energy conservation equation is established by considering a small control volume surrounding the crack tip. The relevant material properties are discussed and presented for a polyurethane rubber (Solithane 113–50/50). The results of the material characterization are used to calculate the crack speed as a function of applied strain and temperature. Author

N69-21526*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCIENTIFIC EXPERIMENTS FOR THE APOLLO TELESCOPE MOUNT
Washington Mar. 1969 60 p refs
(NASA-TN-D-5020) Avail: CFSTI CSCL 17H

The Apollo Telescope Mount is to be a manned solar observatory to make measurements of the sun by placing telescopes and instruments above the earth's atmosphere. These instruments will obtain data on the transitions occurring in elements ionized in the vicinity of the sun's surface. These data are contained in the ultraviolet and x-ray spectrum that is almost completely absorbed by the earth's atmosphere. Orbiting telescopes would also observe flares and regions of the corona that are either hidden to telescopes on earth or are covered with scattered light. The white light coronagraph experiment will therefore be operated outside the light scattering effects of the earth's atmosphere. Two ultraviolet experiments will obtain spectral line intensity and high spectral resolution measurements. Two x-ray experiments will be used to study solar flares and the dynamics of the solar atmosphere. Descriptions of these five experiments and the associated equipment are presented in this report. Author

N69-21555# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
PERIODIC TROJAN ORBITS FOR THE RESONANCE 1/12
Andre Deprit and Eugene Rabe Nov. 1968 18 p Prepared in cooperation with Cincinnati Obs., Ohio /*ts* Math. Note 581
(AD-682119; D1-82-0790) Avail: Issuing Activity CSCL 3/3

A bridge of periodic orbits consisting of a lane of stable orbits and a lane of unstable ones connects the two short period orbits around L sub 4 whose rotation number is equal to 12. Author (TAB)

N69-21561# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REFLECTION PROPERTIES OF VENUS AT 3.8 cm
Richard P. Ingalls, Richard A. Brockelman, John V. Evans, James I. Levine, Gordon H. Pettengill et al 6 Sep. 1968 59 p refs
(Contract AF 19(628)-5167)
(AD-681467; ESD-TR-68-282; TR-456) Avail: CFSTI CSCL 3/2

During the fall of 1967, radar was employed to study the scattering properties of the planet Venus at 3.8-cm wavelength. An increase in the transmitter power to 300 kW CW and a reduction in the system noise temperature to 60 degrees K provided a considerable improvement in the radar performance. The frequency power spectra of the echoes were determined by digital Fourier analysis of the received signals. The total power in each spectrum was computed to yield the value for the radar cross section of Venus. These average 1.75 percent of the projected area of the disk. Author (TAB)

N69-21592# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
DISCOVERY OF AN INTENSE OH EMISSION SOURCE
B. Eliasson and J. F. Bartlett 1969 9 p refs
(Contract N00014-67-A-0094)
(AD-681708) Avail: CFSTI CSCL 3/2

This letter reports the discovery of a bright OH emission source at 1612.231 MHz in the constellation Canis Major. The source was discovered with the Owens Valley interferometer in October, 1968. There is a bright infrared object listed close to the position of the source in the Caltech catalog of infrared stars (Neugebauer and Leighton 1968). This infrared object has been identified with an irregular variable, VY Canis Majoris. Author (TAB)

N69-21647*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THERMAL MODELS AND MICROWAVE TEMPERATURES OF THE PLANET MERCURY
David Morrison 31 Jan. 1969 82 p refs
(Grant NGR-09-215-015-023)
(NASA-CR-100525; SAO Special Repr-292) Avail: CFSTI CSCL 03B

Several physical properties of the uplift of Mercury can be investigated by a comparison of infrared and microwave brightness temperatures with the predictions of theoretical thermal models of the planet. The results presented have been obtained by numerical solution of the one-dimensional heat-conduction equation with temperature-dependent thermal conductivity, using surface boundary conditions that include the modification of the insolation cycles by the spin-orbit coupling and large orbital eccentricity of the planet. For comparison with microwave observations, disk-averaged brightness temperatures are presented as a function of phase angle and heliocentric longitude of Mercury for wavelengths of 0.12, 0.34, 0.80, 1.90, 3.75, and 11.30 cm. These predictions are compared with calculations from simpler lunar-type models and are used to analyze the existing infrared and micro-wave observations of the planet. Author

N69-21720# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLAR WIND AND THE SHOCK WAVE PROPAGATING FROM FLARES THROUGH INTERPLANETARY SPACE
A. S. Dvoryashin Jun. 1968 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Krymsk. Astrofizicheskaya Observ. (USSR), v. 36, 1967 p 126–133
(AD-681615; FTD-MT-24-155-68) Avail: CFSTI CSCL 3/2

The spiral structure of the interplanetary magnetic field, resulting from continuous radial expansion of the solar corona in interplanetary space, is confirmed by the results of an investigation of temporal regularities in absorption phenomena in the polar cap due to high-energy particles from proton flares. On the basis of a sufficiently large number of cases it was found that the propagation velocity of the agent, responsible for the sudden commencement (SC) of magnetic storms, through interplanetary space is higher by a factor of 2-4 than that of the solar wind. It is concluded that the SC of magnetic storms is due to the passage of the earth through a collisionless shock front. In one case the width of the front computed for a collisionless shock wave at small Mach numbers coincided with that of the front measured directly in interplanetary space. The structure of the interplanetary magnetic field, deformed by the propagating shock wave from the sun is discussed. Author (TAB)

N69-21784 Royal Greenwich Observatory, Herstmonceux (England).
THREE-COLOUR PHOTOMETRY OF 4000 NORTHERN STARS
Olin J. Eggen 1968 140 p refs Prepared jointly with Roy. Obs., Cape Town, South Africa *Its* Bull. No. 137
Copyright. Avail: HMSO £1 3S

Twelve thousand (U,B,V) observations of 4000 stars, made with the Mount Wilson and Palomar reflectors in 1962–1964, are discussed. Author

N69-21792# Colorado Univ., Boulder.
SUNSPOT MOTION STATISTICS
Helen E. Coffey Nov. 1968 77 p refs
(Contract F19628-67-C-0304)
(AD-681456; AFCRL-68-0635; SR-3) Avail: CFSTI CSCL 3/2

The document covers the basic characteristics of sunspot movement as developed in previous statistical investigations. Some of the difficulties in relating spot movements to large-scale photospheric motions, and possible terrestrial atmospheric analogues, are discussed. The differential rotation rate is studied. Bigger spot group speeds in longitude and latitude drift patterns are studied. The correlation between longitude and latitude motions indicates momentum transport toward the equator at all latitudes studied. We have also computed correlations involving various spot area parameters and spot motions. Possible explanations of the significant results are discussed. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-20792 Texas Univ., Austin.
ON THE SYNTHESIS OF SUBOPTIMAL SPACECRAFT ATTITUDE-CONTROL SYSTEMS
William Lash Garrard, Jr. (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10834

New approaches for the synthesis of suboptimal, spacecraft, attitude control systems are applied to the design of systems using inertia wheels for fine control and gas jets for coarse control. The various techniques developed compensate for the effects of the more important inter-axis coupling terms, and give better performance than systems designed by conventional techniques or suboptimal systems designed on the basis of time-invariant approximations of the equations of motion. In computer simulations, systems designed on the basis of the procedures outlined in this study are shown to respond faster and more accurately than those designed by conventional transform techniques or by optimization procedures based on time-invariant approximations of the equations of motion. The suboptimal systems have lower peak torque and peak power requirements than systems designed by use of standard transform techniques. Dissert. Abstr.

N69-20811*# Northrop Corp., Huntsville, Ala. Nortronics.
ADVANCED LAUNCH VEHICLE COMPUTER PROGRAM FOR FLYBACK AND RECOVERY TRAJECTORIES
T. E. Perkins, J. von Puttkamer, and D. P. Conrad Mar. 1968 226 p
(Contract NAS8-20082)
(NASA-CR-98369; TR-793-8-302; TR-374) Avail: CFSTI CSCL 22D

A computer program is designed to calculate the flyback and recovery flight of a lifting booster vehicle after its ascent mission is completed. Upon booster staging, the flyback sequence is initiated, and the vehicle descends, turns, decelerates, cruises, and glides down to landing at the desired base. Range, azimuth, fuel utilization, latitude, and longitude data throughout the whole mission are included. This program is written in FORTRAN II language and is suitable for the SDS 930 or CDC 3200 computer, and could be adapted to larger computers with little difficulty. Author

N69-20896*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF SATELLITE SPIN ON EXPLORER 33 AND 35 DOPPLER TRACKING DATA
J. W. Marini and C. W. Murray, Jr. Feb. 1969 40 p refs
(NASA-TM-X-63490; X-551-69-52) Avail: CFSTI CSCL 22A

Tracking data obtained by the Goddard Range and Range Rate Tracking Stations from Explorer 33 and 35 Satellites is analyzed. The residuals of the range rate data contain periodicities related to the spin of the satellites and the data sampling rate. Analysis of the satellite antenna indicates that the periodicities are caused by variations in the phase pattern of the antenna, which can also produce a fixed bias in the range-rate measurement. Using a non-linear model the spin rate can be determined from the data. For the two examples given in the report, the rms of the residuals from the non-linear model is reduced by a factor of 1/2 and 1/3 compared to the rms of the residuals from a least squares straight line fitted to the same data. Author

N69-20966*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FULL-SCALE DYNAMIC LANDING-IMPACT INVESTIGATION OF A PROTOTYPE LUNAR MODULE LANDING GEAR

Ulysse J. Blanchard Washington Mar. 1969 43 p refs Film supplement number L-1011 to this report is available on loan from NASA, Langley Research Center, Langley Station, Va.
(NASA-TN-D-5029) Avail: CFSTI CSCL 22B

The full-scale tests were conducted with a planar (three degrees of freedom) lunar gravity simulator and a full scale test vehicle. Structural integrity of a prototype landing gear system (struts and deployment trusses) was substantiated. Dynamic performance of the landing gear struts was good for all landing conditions tested including those which produced near maximum strokes and loads. Theoretical results were in agreement with experimental results obtained for landing accelerations, gear forces and strokes, and vehicle pitch motions. Author

N69-21006# European Space Research and Technology Centre, Noordwijk (Netherlands).
A FEASIBILITY STUDY ON THE CONFIGURATION FOR THE ESRO LARGE ASTRONOMICAL SATELLITE
R. Somoza Paris ESRO May 1968 134 p refs
(ESRO-TN-28-ESTEC) Avail: CFSTI

The state of thinking in December 1967 on the configuration of the ESRO Large Astronomical Satellite (LAS) is presented in an integrated configuration/structural/thermal feasibility study, following an overall system approach. The reasons for the choice of the present approach and for rejecting other alternatives are discussed and conclusions on the feasibility of achieving the different requirements finally drawn, together with recommendations for future studies. A very small amount of analysis, in relation to the structure and the thermal control, is included in the appendices for the purpose of obtaining the basic information in relation to feasibility. As a general conclusion, the approach followed seems attractive and feasible provided some problems are solved, especially in relation to the weight and thermal tolerances. These problems should be studied in more detail as soon as possible. Early study of some other development problems is recommended. Author (ESRO)

N69-21017*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SMALL ASTRONOMY SATELLITE (SAS) PROGRAM
Marjorie R. Townsend Washington Mar. 1969 23 p
(NASA-TN-D-5099) Avail: CFSTI CSCL 22B

The Small Astronomy Satellite (SAS), one of NASA'S newest Explorer-class programs, can provide at relatively low cost much previously unavailable basic information on low and high energy radiation from sources both inside and outside the galaxy. This report gives sufficient information concerning the SAS volume and weight, and the power, command, telemetry, and control systems to permit the reader to ascertain its suitability for specific astronomy experiments. Project reliability requirements and environmental test conditions are included in the appendixes. Author

N69-21021*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-55, VOLUME 1 FOR THE PERIOD 1 NOVEMBER TO DECEMBER 1968. FLIGHT PROJECTS
31 Jan. 1969 55 p
(Contract NAS7-100)
(NASA-CR-100432; JPL-SPS-37-55-Vol-1) Avail: CFSTI CSCL 22B

Systems preparations for the Mariner Mars 1969 Project were completed and two Atlas/Centaur launch vehicles were checked and tested on pads prior to launch and start of flight operations. The primary objective of the project is to make two flyby missions to Mars and to develop Mars mission technology. A functional description of the Mariner Mars 1971 mission is also given; its principal experiments are measurements of atmospheric and surface parameters to determine the dynamic characteristics of the planet and to map a large portion of the Martian surface. G.G.

N69-21038*# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Eastern Div.
SOFT LANDER. PART 9: MARS SOFT LANDER CAPSULE STUDY (ENTRY FROM ORBIT) ANALYSIS OF INFLATABLE LANDING SYSTEMS
Washington NASA Sep. 1968 70 p
(Contract NAS1-7977)
(NASA-CR-66665-9; G346) Avail: CFSTI CSCL 22B

Use of high stroke, inflatable landing system for a Mars landing was investigated. This investigation was initiated because of the potential capability of achieving a landing where the equipment experiences much lower landing decelerations than those associated with hard landers and not incurring the cost of terminal propulsion and terminal guidance systems required for soft landers. This study was constrained to landing velocities of 50 to 250 ft/sec and payload weights of 100 to 400 lb. These are considered ranges of interest for a low cost, 1973 Mars Lander and are consistent with the use of a parachute as a single, terminal decelerator. Objectives established for this study were to determine the feasibility of an inflatable landing system for Mars landings and to provide preliminary estimates of dynamic characteristics. The key parameter needed to aid in defining feasibility is the energy absorption capability of the torus. Author

N69-21085*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELAY PROGRAM Final Report
Washington 1968 368 p refs
(NASA-SP-151) Avail: SOD $3.25; CFSTI CSCL 22B

The operations of Relay 1 and 2 are summarized for the period July through December 1964. The performance of the two spacecraft is compared and certain design modifications incorporated in Relay 2 as a result of experience with Relay 1 are described. The results of the Relay 2 communication experiments conducted by the Mojave Station from 1 January through 1 July 1965 are presented. In describing the Relay 2 performance, the format of the Project Relay Communication Experiments Plan R1-0521 is generally followed. Similar experiments, conducted by ground stations in other countries, are also reported. The station included: Raisting, Germany; Fucino, Italy; Kashima and Ibaraki, Japan; Rao, Sweden; Grinon, Spain; and Goonhilly Downs, England. B.P.

N69-21086*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
DATA ANALYSIS IN CONNECTION WITH THE NATIONAL GEODETIC SATELLITE PROGRAM (2) Semiannual Status Report, Aug. 1968-Jan. 1969
Jan. 1969 12 p refs
(Grant NGR-36-008-093)
(NASA-CR-100409; SASR-3) Avail: CFSTI CSCL 22B

Computer programs were extended to handle range differences as observed quantities for both the purely geometric and the short arc modes. In the latter, the orbit is approximated by Keplerian orbit with six parameters to be determined. For the observations of range differences, it was assumed that in order to compensate for eventual systematic frequency shifts, one parameter should be added for each satellite pass and each station. The main purpose of the program will be its eventual use in connection with Geoceiver observations. Experiments with BC-4 data were continued. These experiments were concerned with the feasibility of adjusting the

data in an orbital mode as well as with various methods of treating the data in a geometric mode. The data was extended to include 45 plates, taken from four stations and comprising 21 events. The results are tabulated; all of the experiments in the 45-plate series yielded reasonable estimates of the unit variance, so that the results were directly comparable. Essentially all of the simultaneous optical data (PC-1000, MOTS, and BC-4) was received, the times converted to UT1, and the correction for parallactic refraction was made. The screening, analysis, handling, and processing of this data is continuing. B.P.

N69-21091*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VARIATIONS IN LAUNCH VEHICLE PERFORMANCE FROM A MISSION PLANNING VIEWPOINT
A. N. Williams 1 Sep. 1968 11 p
(Contract NAS7-100)
(NASA-CR-100428; JPL-TM-33-400) Avail: CFSTI CSCL 22D

Launch vehicle performance is discussed from the user's point of view and with respect to payload determination in early phases of spacecraft design and mission planning. The emphasis is on the differences between (1) performance guaranteed for a specific, well-identified mission and (2) performance estimated on a general basis before the mission has been studied in depth by the cognizant agencies. Checklists of requirements are presented as aids in reviewing preliminary launch vehicle weight and performance data. These can assist in determining that the factors that affect the weight of spacecraft support hardware and mission-peculiar jettison weight of the injection stage have been recognized. Author

N69-21111*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ON LATERAL CABLE OSCILLATIONS OF CABLE-CONNECTED SPACE STATIONS
Willard W. Anderson Washington Mar. 1968 85 p refs
(NASA-TN-D-5107) Avail: CFSTI CSCL 22B

The influence of lateral cable oscillations on a spinning cable-connected space station is defined in terms of steady-state and transient response to torques acting on the space station. The system is defined by using linear rigid-body equations and a dual formulation of the cable modes. Damping is included in the dual formulation and estimates of this damping are provided. The analysis allows a determination of the required depth of modeling for a given system in terms of the system parameters and the expected disturbances. Energy flow within the system is discussed by using a system bond graph. Author

N69-21224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GRAVITY GRADIENT EFFECTS ON AN ATTITUDE-CONTROLLED SATELLITE
T. Kerner 15 Oct. 1968 19 p refs
(Contract NAS7-100)
(NASA-CR-100491; JPL-TM-33-409) Copyright. Avail: CFSTI CSCL 22A

A spacecraft orbiting about a planet is normally subject to torques caused by gravity-gradient effects. Studies of missions involving orbiting spacecraft require that these torques be analytically described. This report describes a derivation that results in expressions to describe these torques. The gas weight required to offset these torques for a *Mariner*-type attitude-controlled spacecraft is also derived; the results are directly applicable to *Mariner* Mars 1971 gas budget sizing. Author

N69-21247# National Environmental Satellite Center, Washington, D. C.
COMPUTER PROCESSING OF TOS ATTITUDE DATA
J. F. Cross Nov. 1968 17 p refs
(PB-182125; NESCTM-6) Avail: CFSTI CSCL 22A

This memorandum describes the computer program used operationally at the National Environmental Satellite Center (NESC) to determine the attitude of a TIROS Operational Satellite (TOS). It includes background information of historical interest, specific details of the problem and its solution, and thoughts about future approaches. It is intended as a description of this part of the NESC operation and as an introduction to the more esoteric program documentation. Author (USGRDR)

N69-21287# Laboratoire de Recherches Balistiques et Aérodynamiques, Vernon (France).
RANGE TABLE FOR VERONIQUE 61 M ROCKET VEHICLE [TABLE DE TIR VERONIQUE 61 M]
J. Terracol 3 Dec. 1968 34 p In FRENCH Supersedes LRBA-NT-73/66/EN
(Contract CNES/0694)
(LRBA-NT-83/68/SEN-SY; LRBA-NT-73/66/EN) Avail: CFSTI

Curves giving range, culmination altitude and time of culmination versus elevation angle for different mass of the nose cone and different total length of the rocket. ESRO

N69-21333# Royal Aircraft Establishment, Farnborough (England).
OBSERVING ARTIFICIAL SATELLITES
D. G. King-Hele Jan. 1968 22 p refs Presented at the Brit. Astron. Assoc. Christmas Lecture, 27 Dec. 1967
(RAE-TM-Space-104) Avail: CFSTI

This paper records the Christmas Lecture of the British Astronomical Association, given on 27 December 1967. The methods of observing artificial Earth satellites are briefly reviewed, in a light and non-technical style, with particular emphasis on visual observing. Author (ESRO)

N69-21399*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ATLAS-CENTAUR AC-11 FLIGHT PERFORMANCE FOR SURVEYOR 4
Washington 14 Apr. 1969 157 p
(NASA-TM-X-1768) Avail: CFSTI CSCL 22B

The final evaluation of the Atlas-Centaur AC-11 vehicle systems performance for the Surveyor 4 mission is given, from lift-off through the Centaur retromaneuver. Successful launching and achievement of mission objectives are described. A detailed systems analysis is presented for the propulsion, pneumatic, hydraulic, propellant loading and utilization, separation and jettison, electrical, guidance, and control systems, and for the vehicle structures. Supplemental flight, trajectory, and performance data are included, along with performance calculation techniques for the Centaur engine. P.A.B.

N69-21419# European Space Research Organization, Paris (France).
ESRO/ELDO BULLETIN, NUMBER 4
Jan. 1969 44 p refs Partly in ENGLISH; Partly in FRENCH Prepared jointly with ELDO
Avail: CFSTI

CONTENTS:

1. THE RESOLUTIONS ADOPTED BY THE EUROPEAN SPACE CONFERENCE p 8-13 (See N69-21420 10-34)

2. THE F7 FLIGHT TEST OF THE EUROPA 1 SATELLITE LAUNCHER P. Rochefort (European Space Vehicle Launcher Develop. Organ.) p 14–19 (See N69-21421 10-31)

3. SEPARATION SYSTEMS IN THE EUROPA 1 LAUNCHER M. E. Leniston (European Space Vehicle Launcher Develop. Organ.) p 22–28 (See N69-21422 10-31)

4. PROGRESS IN OPERATIONAL PROGRAMME p 31–35 (See N69-21423 10-31)

N69-21421# European Space Vehicle Launcher Development Organization, Paris (France).

THE F7 FLIGHT TEST OF THE EUROPA 1 SATELLITE LAUNCHER [L'ESSAI EN VOL F7 DU LANCEUR DE SATELLITE EUROPA 1]

P. Rochefort *In* ESRO/ELDO Bul. No. 4 Jan. 1969 p 14–19 (See N69-21419 10-31) In ENGLISH and in FRENCH

Avail: CFSTI

Describes briefly the F7 flight test of EUROPA I launched from Woomera. For the first time all three stages and the test satellite were alive. Among the objectives achieved were: the eighth successful test of the first stage; the complete and correct functioning of the separation systems between the first three stages; the correct ignition of the third stage motors. Due to a failure of the third stage motor satellite orbit injection was not achieved although the satellite functioned correctly until the loss of telemetry signals. (ESRO)

N69-21422# European Space Vehicle Launcher Development Organization, Paris (France). Engineering Coordination Directorate

SEPARATION SYSTEMS IN THE EUROPA 1 LAUNCHER

M. E. Leniston *In* ESRO/ELDO Bul. No. 4 Jan. 1969 p 22–28 (See N69-21419 10-31)

Avail: CFSTI

Describes the separation systems in the EUROPA 1 launch vehicle. Gives details of the operative separation sequences between first and second stage, third stage and the satellite and of the jettisoning of the fairings. The third stage middle skirt separation which will operate on future vehicles is also described. (ESRO)

N69-21423# European Space Research Organization, Paris (France).

PROGRESS IN OPERATIONAL PROGRAMME [ETAT D'ADVANCEMENT DU PROGRAMME OPERATIONNEL]

In its ESRO/ELDO Bul. No. 4 Jan. 1969 p 31–35 (See N69-21419 10-31) In ENGLISH and in FRENCH

Avail: CFSTI

Two sounding rocket (type Centaure and Skylark) launching campaigns from ESRANGE in October and November 1968 are reported. Interspersed with the ESRO launchings were two national campaigns by Sweden and Germany. The 1968 program scheduled for the Sardinia range ended with the successful launching of two Skylark rockets. The latest information is also given on ESRO 2 (Iris) and ESRO 1 (Aurorae) satellites. ESRO

N69-21512# Space Data Corp., Phoenix, Ariz.

DESIGN, DEVELOPMENT, AND FLIGHT TESTS OF CHEMICAL RELEASE PAYLOADS FOR UPPER ATMOSPHERE RESEARCH Final Report, 1 Jul. 1965–31 Aug. 1968

Edward F. Allen, Jr. Sep. 1968 228 p

(Contract AF 19(628)-5126; ARPA Order 1141)

(AD-681833; SDC-TM-328; AFCRL-68-0587) Avail: CFSTI CSCL 4/1

Rocket borne chemical payload systems were designed, developed and flight tested to give controlled releases of gases, liquids and solids. Payloads consisted of chemical tanks, chemicals, fluid controls with associated plumbing, event programmer and aerodynamic envelope. Trimethylaluminum, Diborane, Nitric Oxide, High Explosives seeded with metals, Barium/Copper Oxide and Cesium Nitrate/Aluminum/Tungsten systems were provided. Chemical handling techniques were developed and engineering field services were provided to assist with payload launches. Author (TAB)

N69-21550# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.

INCLUSION OF THE TIME CONSTRAINTS AND REDUNDANT ACCESS ON SPACECRAFT RETURN PROBABILITIES BY THE CONCEPT OF BOREL SET Technical Report, Nov. 1967–Jul. 1968

S. T. Chu and A. R. Nagy, Jr. Dec. 1968 40 p refs

(Contract F04701-68-C-0200)

(AD-682308; TR-0200(4525-04)-1; SAMSO-TR-69-23) Avail: CFSTI CSCL 22/1

Because of limitations of weather, sea state, and visibility, planning efforts for the emergency return by abort or escape from orbit to contingency recovery sites must consider factors of local time constraints and redundant access. The first factor provides a means of evaluating the impact of a daylight return requirement; the second permits appraising safer emergency recovery plans when unacceptable weather or sea state conditions exist at the initially selected recovery site. The return probability of spacecraft including these factors involves the determination of coverage belts along the equator that are generated by the loci of ascending nodes of orbits from which the recovery circle can be reached within the local time constraints and with the specified degree of redundancy in access. In general, the coverage belts collectively form a complicated and juxtaposed set. By using the linear Borel set concept, a logic is developed for properly counting and summing these belts to arrive at a general formulation for determining the return probability. Sample results show that the local time constraints have a significant effect upon the return probability. The seasonal variation of available daylight hours can also have pronounced influence on the return probability and the required waiting time for an assured emergency return if the recovery sites are in the same hemisphere. On the other hand, redundant access of the second degree, while having a lower return probability than single access, does not greatly increase the required waiting time for an assured emergency return of a spacecraft. Author (TAB)

N69-21573# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

SELECTION OF SPACE BEACON ORBITS FOR A CONTINUOUSLY-OPERATIVE SYSTEM OF NAVIGATIONAL SATELLITES

E. N. Perevezentsev Nov. 1968 25 p refs

(Contract Now-62-0604)

(AD-681778; CLB-3-1-568) Avail: CFSTI CSCL 22/3

An uncontrolled satellite network of special configuration, for global navigational-satellite systems that are continuously operative within assigned belts of longitude and latitude of the earths surface, is examined. The solutions proposed to provide for navigation of ships at sea using these systems are based on the theory of the Keplerian motion of satellites in the central gravitational field of a spherical model of the earth. Author (TAB)

N69-21597# Paris Univ. (France). Laboratoire de Physique de l'Atmosphere.

IONOSPHERIC RESEARCHES USING SATELLITES Final Report, 1 Jan. 1964–31 Mar. 1968

Etienne J. Vassy Apr. 1968 108 p refs
(Contract AF 61(052)-761)
(AD-681460; AFCRL-68-0648) Avail: CFSTI CSCL 4/1

The report contains a description of equipments concerning: a reception chain of differential Doppler effect on 40-41 MHz, and the measurement of signals transmitted by beacons of a geostationary satellite. Details are given of studies of the total electron content; data of the laboratory; latitudinal evolution (diurnal variations); ray tracing of waves emitted by satellites through an anisotropic ionosphere; and measurement of ionospheric absorption by satellites. Author (TAB)

N69-21665# Library of Congress, Washington, D. C.
THE SOYUZ 4/SOYUZ 5 JOINT SPACE MISSION
David Wood *In its* Foreign Sci. Bull., Vol. 3, No. 3 Mar. 1969 p 25–44 refs (See N69-21662 10-34)
Avail: CFSTI

This article deals with material concerning the space mission of Soyuz-4 and -5. The rendezvous and docking in space of the two spacecraft to form a "space station" with integrated instrumentation and electrical circuitry has been heralded by the Soviets as a significant stride toward the realization of large manned orbital laboratories. The mission included a spacewalk and transit from one craft to the other by two cosmonauts. Author

N69-21767# National Research Council of Canada (Ontario). Space Research Facilities Branch.
BLACK BRANT ROCKETS AKF-3-39 AND AKF-3-40 LAUNCHED AT RESOLUTE BAY, OCTOBER 1968
Jan. 1969 29 p refs
(PD-6883; SRFB-019) Avail: CFSTI

This report deals with the engineering aspects of preparing the payloads and the launching of Black Brant rockets. Vehicles carried experiments to provide more information on the background x-radiation from space and to measure ionization density profiles and electron density profiles in the D region. The first vehicle achieved an apogee of 96 miles with good telemetry throughtout the flight. On the second vehicle loss of telemetry occurred at T+11 seconds. Author

N69-21859# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NUTATIONAL DAMPING OF A SLOWLY SPINNING SATELLITE STABILIZED BY USE OF A ROTOR
Davinder K. Anand, Peter P. Pardoe, and James M. Whisnant Sep. 1968 40 p refs Revised
(Contract NOw-62-0604)
(AD-681710; APL-TG-997-Rev.) Avail: CFSTI CSCL 22/2

The nutational damping of a slowly spinning satellite, stabilized with a small rotor, is analyzed. The characteristic equation for the case of damper motion in a plane passing through the spin axis is seen to be similar to that of damper motion in a plane perpendicular to the spin axis. A parametric study of the characteristic equation is made for the case of one and two dampers. The damping characteristics of the one damper, with counterweight, appears to be preferable. Author (TAB)

N69-21874# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GEOS-2 COMMANDING AND TELEMETRY REDUCTION IN REAL TIME BY COMPUTER
D. G. Mullens Jul. 1968 63 p refs
(Contract NOw-62-0604)
(AD-681714; APL-TG-1015) Avail: CFSTI CSCL 22/2

This report describes the use of the CDC 3200 Test Stand Data Processor in commanding and telemetry reduction for the GEOS-2 satellite. The processor hardware is described and the methods used to sample, process, and output the telemetry data and to generate commands are discussed. Finally the software that controls the various functions of the processor is described in some detail. Author (TAB)

N69-21906# Goodyear Aerospace Corp., Akron, Ohio.
BALLUTE DEVELOPMENT FOR LOKI-DART AND ARCAS ROCKETSONDES Final Report, Feb. 1966–Aug. 1968
John J. Graham, Jr. Nov. 1968 51 p
(Contract AF 19(628)-5851)
(AD-681455; GER-14010; AFCRL-68-0622) Avail: CFSTI CSCL 4/2

Goodyear Aerospace Corporation completed a program to develop a stabilizing decelerator for the Arcas and Loki-Dart meteorological rocketsondes. During the program of cyclic modification, test, and evaluation, 53 development units were flight tested at the Air Force Eastern Test Range. The design performance goals were reached for both systems. Fifty-five preproduction units of the Loki-Dart BALLUTE were fabricated for further evaluation by Air Force Cambridge Research Laboratories. As a result of this program the Loki-Dart BALLUTE (Parachute, Meteorological A/B28U-5) was incorporated in the standardized PWN-88 Meteorological Rocketsonde currently in production. Author (TAB)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-20706# Montana State Univ., Bozeman. Dept. of Aerospace and Mechanical Engineering.
RESPONSE OF NONLINEAR STRUCTURES TO BLAST Final Report
Dennis O. Blackketter Nov. 1968 81 p refs
(Contract DAAD05-68-C-0129)
(AD-681247) Avail: CFSTI CSCL 20/11

The object of the research was to develop analytical methods for determining the nonlinear response of a structural element subjected to blast loading. Three technical reports were prepared: Elasticity solution by a modified Galerkin method; Permanent deformation of an axial rod subjected to dynamic loading; and Deflection of a circular plate subjected to blast loading. They are included as appendices in this report. The following conclusions were reached: The Modified Galerkin Method will, for a structural systems, yield results which are reasonably accurate. The new concepts introduced for treatment of boundary conditions are valid. The permanent set of an axial rod subjected to dynamic loading can be determined using the proposed methods. The efforts of previous investigators) to determine analytically the permanent deformation of a plate subjected to blast loading have led to poor results because of the fact that the stretching of the plate has been neglected. Author (TAB)

N69-20723 Colorado Univ., Boulder.
THE FREQUENCY ANALYSIS OF THREE-DIMENSIONAL BARS

Jan Joseph Tuma (Ph.D. Thesis) 1967 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-10628

A deductive and comparative study of three general solutions for the frequency analysis of freely vibrating three-dimensional bars is presented. From the transport matrix formed by twelve dynamic parameters of a single bar, the transport chain, the flexibility chain, and stiffness chain methods are developed, and applied to the preparation of frequency determinants of bent bars, and polygonal rings in space. The relationship between the transport, flexibility, and stiffness matrices was established, and the influence of four typical end conditions was considered. The analysis was based on the assumption of linear elasticity, small deformations, linear vibration, with damping neglected, mass, uniformly distributed throughout each segment, and restricted to a system of straight bars with constant, and doubly symmetrical cross-section, connected by rigid joints. Dissert. Abstr.

N69-20796*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONTACT PROBLEMS IN ELASTICITY AND THE SOLUTION FOR A THICK LAYER ON A WINKLER TYPE FOUNDATION
William C. Schneider Feb. 1969 75 p refs
(NASA-TM-X-58023) Avail: CFSTI CSCL 20K

This study presents many aspects of contact problems and a solution for the determination of the stresses and displacements in an arbitrarily thick layer that is resting on an elastic (Winkler type) foundation. The contact problems discussed are the nonlinear bending of beams, the stress in a thin plate resting on an elastic foundation, the stress in a half plane because of surface punches and pressures, the stress in a half space because of surface punches and pressures, and the stress in a layer resting on a rigid base because of surface punches and pressures. The problem of determining the stresses of a thick layer resting on an elastic foundation is then solved for a general surface pressure distribution. Numerical results are presented for the particular case of a surface pressure uniformly distributed over a circle. Author

N69-20844# Wisconsin Univ., Madison. Mathematics Research Center.
EXACT SOLUTION OF CERTAIN DUAL SERIES FOR INDENTATION AND INCLUSION PROBLEMS
B. Noble and M. Hussain Jun. 1968 23 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-681402; MRC-TSR-903) Avail: CFSTI CSCL 20/11

Exact solutions are obtained for certain dual trignometric series that arise in the study of mixed boundary value problems with circular boundaries, in two dimensional elasticity. The problems considered are, (1) An indentation problem: an infinite body with a smooth circular inclusion to which a concentrated force is applied, (2) An inclusion problem: a smooth elastic inclusion in an infinite body subjected to uniform tension at infinity. Author (TAB)

N69-20899*# Aztec School of Languages, Acton, Mass. Research Translation Div.
VIBRATIONS AND STABILITY OF AN ELLIPTICAL SHELL [KOLEBANIYA I USTOYCHIVOST ELLIPTICHESKOY OBOLOCHKI]
B. I. Slepov Washington NASA Mar. 1969 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Mekhan. i Mashinostr. (Moscow), no. 3, 1964 p 144–146
(Contract NASw-1692)
(NASA-TT-F-12155) Avail: CFSTI CSCL 20K

The frequency of free bending vibrational motions of an elliptical shell is calculated approximatively on the basis of the zero-moment theory, as is the stability of such a shell when it is subjected to a uniformly distributed normal pressure. When compared to experiments, the results obtained show accuracy within the range of 2–3%. Author

N69-20929 Louisiana State Univ., Baton Rouge. Agricultural and Mechanical College.
THE THERMAL CONDUCTANCE OF BOLTED JOINTS
John Elton Fontenot, Jr. (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-10735

The primary objective of this investigation was the development of a practical analytical method of determining the interface thermal conductance of a bolted joint from a minimum of design information. Such a method was developed and its validity demonstrated with experimental data. Normal stress distributions under button-head and fillister-head bolts were measured and the results indicate that the common assumption of a uniform stress is not always valid. Measurements of the interface stress distribution between thin bolted plates were made and the results for the extent of the stress region were found to disagree with Sneddon's theory developed for a simplified configuration. This disagreement was found to be important when calculating deflections of bolted plates. Fernlund's simplified approach to determining the interface stress distribution, previously verified for thick plates, was shown to be invalid for thin plates. Dissert. Abstr.

N69-21001 Vanderbilt Univ., Nashville, Tenn.
A FINITE ELEMENT TECHNIQUE FOR THE IDEALIZATION OF CONTINUOUS SHELL STRUCTURES
David Martin Bayer, II (Ph.D. Thesis) 1968 204 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-12772

The structures to be investigated are limited in this research to thin shells of revolution. The techniques presented are applicable to plates and shells in general. In order to analyze a continuous elastic shell, the continuous material of the elastic body may be replaced by a framework of bars, arranged in a definite pattern, which geometrically approximates the original structure. These bars must be given elastic properties suitable to the type of problem being investigated. By analyzing the framework with these special properties and spreading the bar stresses over a certain area, the stresses in the original body can be approximated. A short analysis was made into equation solving techniques including an accuracy and speed study. The methods considered were matrix inversion, iteration, and elimination. Dissert. Abstr.

N69-21010*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF THERMALLY INDUCED STRUCTURAL VIBRATIONS BY FINITE ELEMENT TECHNIQUES
James B. Mason Aug. 1968 31 p refs
(NASA-TM-X-63488; X-321-68-333) Avail: CFSTI CSCL 20K

A brief review of the classical continuum approach to thermoelasticity problems is given. It is shown that an analogous technique can be used to reduce the study of thermally induced vibrations by finite element techniques to that of a forced response analysis of the idealized structure excited by time dependent equivalent mechanical loads. Equivalent mechanical loads for beam and rectangular plate elements are presented. These time dependent loads are evaluated and employed to treat two sample problems for which exact solutions of the differential equations of motion exist. The samples considered are those of a simply supported beam and a simply supported plate exposed to a uniform step heat input over one face. Results of the finite element analyses are compared to the exact solutions for these two cases. Author

N69-21042*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va.
EFFECTS OF BOTTOM-STRUCTURE FLEXIBILITY ON WATER LANDING LOADS OF APOLLO SPACECRAFT MODELS
Sandy M. Stubbs and Melvin E. Hathaway Washington Mar. 1969 31 p refs
(NASA-TN-D-5108) Avail: CFSTI CSCL 20K

A landing investigation has been made to determine the effects of heat-shield flexibility on pressures and accelerations for water landings of Apollo spacecraft models. An additional purpose was to obtain accurate acceleration data on the landing impact of a spherical body in water for use in refinements of rigid-body analytical calculations. Two solid models and one flexible-bottom model were tested to determine impact pressures and accelerations. The flexible bottom was scaled in stiffness from an early Apollo heat-shield structural design. The test conditions were limited to symmetrical landing attitudes (0°) without horizontal velocity in order to obtain pressure profiles and loads on the bottom surfaces of the models from a limited number of data channels. Two vertical velocities were used to determine the effect of velocity on the forces applied to the flexible bottom. Good agreement was obtained between computed and experimental acceleration results for the solid models. Results from this investigation indicate that a virtual water mass factor of 0.9 should be used in computing impact forces for rigid spherical surfaces shaped like the Apollo aft heat shield. Pressure profiles were obtained from which forces and accelerations could be derived. The pressures, forces, and accelerations on the solid models vary approximately as the square of the velocity. Author

N69-21050*# Rohr Corp., Chula Vista, Calif.
FABRICATION AND TEST OF LIGHTWEIGHT HONEYCOMB SANDWICH STRUCTURES Final Report
James A. Scholl, Muriel L. Koss, and Jack E. Dawson 30 Jan. 1969 268 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951612)
(NASA-CR-100450; ER-24-1512) Avail: CFSTI CSCL 11D

Various combinations of metallic and nonmetallic materials were evaluated in constructing lightweight bonded honeycomb structures. This includes both the determination of mechanical and physical properties of minimum and other gage material combinations and the establishment of optimum fabrication techniques. Honeycomb sandwich test panels were fabricated from a potential list of eighty different reinforced plastic material combinations. These included material and configuration variations in the face sheets, honeycomb core, and core-to-face sheet adhesive. Facings of phenolic, epoxy, polyimide, and polyester resin systems were evaluated using various numbers of plies of several styles of fiberglass cloth laid up at different orientations. Face sheet splice and repair methods were also investigated. Hexagonal, flexcore, and dovetail honeycomb core with various cell sizes, densities, and thicknesses were used with a standard face sheet to determine comparative results. Core splice techniques were also evaluated. A comparison was made of resin bonded panels and those utilizing epoxy, epoxy-phenolic, and polyimide adhesives which varied in thickness and form. Author

N69-21059# National Research Council of Canada, Ottawa (Ontario).
FINITE PLATE BENDING ELEMENTS IN POLAR COORDINATES
Mervyn D. Olson, Garry M. Lindberg, and Helen A. Tulloch Oct. 1968 37 p refs
(NRC-10575; LR-512) Avail: CFSTI

Two finite elements for plate bending in polar coordinates are derived. One element is in the form of a circular sector and the other is in the form of an annular sector. The former element has nine degrees of freedom, while the latter has twelve, the degrees of freedom in each case being a displacement and two slopes at each element corner. The method is checked with several numerical examples. The static deflections of an annular plate and a complete circular plate, both loaded by single concentrated forces, are analyzed and the results compared with exact solutions. Calculations of the free vibrations of complete circular plates are also carried out and compared with exact solutions. Author

N69-21060# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
THERMODYNAMIC FOUNDATION OF FINITE ELASTIC LOCKING MEDIUM
C. T. Sun Dec. 1968 61 p refs
(Rept-70) Avail: Issuing Activity $3.00

A detailed literature survey of the historical development of locking material is presented. The practical application of a locking medium is discussed, and, introducing an equation of state, the various thermodynamic state variables are calculated. The constitutive equations and the entropy equations for finite deformation are derived using an irreversible thermodynamic process. The general theory is also specialized to a discussion of the thermodynamics of a homogeneous isotropic elastic perfectly locking medium. As an application, a general mathematical theory of finite thermoelasticity for an elastic perfectly locking material is formulated. Author

N69-21125# Royal Aircraft Establishment, Farnborough (England).
ESTIMATION OF THE RELIABILITY OF FATIGUE LOADED STRUCTURAL COMPONENTS [BEURTEILUNG DER ZUVERLAESSIGKEIT SCHWINGBEANSPRUCHTER BAUTEILE]
E. Haibach Aug. 1968 21 p refs Transl. into ENGLISH from Sonderdruck aus Luftfahrttech. Raumfahrttech. (West Ger. issue 13, no. 8, 1967 p 188–193
(RAE-Lib-Trans-1314) Avail: CFSTI

Proceeding from the scatter distribution of the allowable fatigue loads and the scatter distribution of the actual working loading, the probability of failure of fatigue loaded structural components can be determined for every given value of the service life, and thus a measure of the component's reliability found. The traditional, usually empirically determined, safety factor is now found as a statistically based safety range dependent on the particular failure probability. The analysis first of all sets out to explain the principal features of the concept involved. Finally, difficulties which may arise in practical cases are considered, and by means of a simplified calculation of the failure probability a way out of these difficulties is indicated. Author

N69-21151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF STRUCTURAL ANALYSIS AND MATRIX INTERPRETIVE SYSTEM
R. M. Bamford 15 Oct. 1968 30 p refs
(Contract NAS7-100)
(NASA-CR-100461; JPL-TM-33-399) Copyright. Avail: CFSTI CSCL 20K

The matrix manipulations required for common structural analysis problems are developed, the control cards that direct the structural analysis and matrix interpretive system to perform these operations are listed, the required data are described, and a sample problem is given. Author

N69-21154# National Aeronautical Lab., Bangalore (India).
APPLICATION OF MATRIX DISPLACEMENT METHODS IN THE STUDY OF PANEL FLUTTER
Kariappa and B. R. Somashekar Feb. 1968 19 p refs
(NAL-TN-7) Avail: CFSTI

A finite element approach to the panel flutter problem was attempted. A method to derive the aerodynamic influence coefficient matrices kinematically consistent with the stiffness and inertia matrices, was suggested. These matrices were employed in the formulation of the dynamic equations of motion and the system of equations solved for their complex eigen values and vectors by the usual methods. This approach is general and is applicable to any boundary conditions. Some examples were worked out, on a computer, for simply supported panels in supersonic flow and the results were found to be in good agreement with those from other conventional methods. Author

N69-21388# Adviesbureau der Genie, The Hague (Netherlands).
TABLES FOR CALCULATING THE STRENGTH OF REINFORCED CONCRETE PLATES WITHOUT EARTH COVER AGAINST EXPLOSIVE LOADS [TABELLEN VOOR DE BEREKENING VAN GEWAPEND BETONPLATEN ZONDER GRONDDEKKING TEGEN EXPLOSIEBELASTING]
C. Floksta Jul. 1968 97 p In DUTCH *Its* Verslag Nr. 194
(TDCK-51802III) Avail: CFSTI

Tabulated computer results are presented of strength calculations expressed in ductility factors for reinforced concrete plates of eight different geometrical configurations. For each configuration, the ductility factor was calculated for five different thicknesses and as a function of varying peak pressures, pressure phase durations, percentages of reinforcement, and buckling values. Plate thicknesses ranged from 25 cm for a 180 × 290 cm configuration (smallest) to 80 cm for a 1080 × 1080 cm configuration (largest). Transl. by K.W.

N69-21392*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS INFLUENCING LOW CYCLE CRACK GROWTH IN 2014-T6 ALUMINUM SHEET AT −320°F (77K)
William S. Pierce and Timothy L. Sullivan Washington Apr. 1969 43 p refs
(NASA-TN-D-5140) Avail: CFSTI CSCL 20L

An investigation was conducted to determine the low-cycle (under 10,000 cycles) crack growth characteristics of through-center-cracked specimens 0.060 in. thick subjected to tension–tension cyclic loading. The following factors were studied: minimum to maximum initial stress intensity ratio R_i; the maximum gross stress applied, as percentage of critical fracture stress; and cyclic rate. The crack growth rate was found to be a function of stress level expressed as percentage of critical fracture stress for specimens tested at the same R_i value. A crack growth relation was developed which takes into account changes in R_i in the low-cycle region. When the cycle rate was decreased from 0.5 to 0.05 Hz, the cyclic life was reduced, but only for high initial stress intensities. Author

N69-21401*# General Technology Corp., Lawrenceville, N. J.
A CONTINUUM THEORY FOR AN ELASTIC SOLID WITH ELASTIC MICRO-INCLUSIONS
L. M. Habip Washington NASA Mar. 1969 24 p refs
(Contract NASw-1589)
(NASA-CR-1321; TR-8-7) Avail: CFSTI CSCL 20K

By analogy with the results of a higher order continuum theory, explicit dispersion relations governing the lowest and next higher modes of propagation of plane, longitudinal waves in an unbounded, elastic particulate composite solid are obtained in terms of the relative properties of the constituent materials. The corresponding ratio of group velocity to phase velocity is likewise evaluated. These and further relationships valid for a special case are exhibited graphically. Author

N69-21403*# City Coll. of the City of New York.
DYNAMIC RESPONSE OF STRUCTURAL ELEMENTS EXPOSED TO SONIC BOOMS
David H. Cheng and Jacques E. Benveniste Washington NASA Mar. 1969 47 p refs
(Grant NGR-33-013-011)
(NASA-CR-1281) Avail: CFSTI CSCL 20K

The structural elements of interest are uniform beams and plates with various boundary conditions. The disturbances are represented by a variety of boom signatures which approximate those obtained from field measurements. Responses of structural elements to a unit impulse and to a unit force moving at a constant velocity are first obtained. This enables a comparison to be made of the relative dynamic effects of an N-shaped pressure pulse and an N-shaped traveling wave on a simple structure. It is followed by a study on the effects of boundary restraints using an N-shaped pressure pulse. Based on the results due to such idealized boom signatures as sine pulse, half-cosine pulse, triangular pulse, N-shaped pulse, and N-shaped pulse with spikes, two simplified methods in evaluating the boom effects on structural elements are proposed: One requires only the knowledge of the peak pressure and the other, the positive impulse. Neither requires the specification of the exact shape of the boom signature. Author

N69-21418# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
ON THE NONLINEAR OSCILLATIONS OF PLATES COMPOSED OF COMPOSITE MATERIALS
Cheng-ih Wu and Jack R. Vinson Sep. 1968 30 p refs
(Grant NSF GK-684)
(TR-91) Avail: Issuing Activity

Berger's approach for large deflections and a modified Reissner's variational principle are exploited to treat the nonlinear dynamic problem of plates. A system of approximate equations which governs the large amplitude free vibrations of orthotropic, rectangular plates is presented, including the effects of rotatory inertia and transverse shear deformation. In the example, a simplified solution is given for the primary lateral vibration of a simply supported plate. Numerical results are based upon the elastic constants of a composite material, having boron filaments 58.1% by volume, imbedded in an epoxy matrix. Author

N69-21569*# General Technology Corp., Lawrenceville, N. J.
ON THE DETERMINATION OF MICROMORPHIC MATERIAL CONSTANTS FROM PROPERTIES OF THE CONSTITUENTS
Richard F. Maye Washington NASA Mar. 1969 24 p refs
(Contract NASw-1589)
(NASA-CR-1320; TR-8-6) Avail: CFSTI CSCL 20K

Using relationships given by Eringen and Suhubi on the general theory of micro-elasticity, this report studies the relationship of a linear micromorphic material to linear classically elastic constituents and also investigates the possibility of obtaining the material constants from the properties of the constituents. The special case of a two constituent isotropic micromorphic material is considered in detail. For this case, all constituent properties except three are easily evaluated. Determination of the eighteen micromorphic material moduli and the micromorphic inertia constant is therefore reduced to the experimental determination of the three unknowns. A.L.

N69-21582# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
REVIEW OF SOME INVESTIGATIONS ON FATIGUE IN THE NETHERLANDS
A. Hartman, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 21–53 refs (See N69-21581 10-02)
(NLR-MP-249) Avail: CFSTI

An analysis of fatigue tests on 7075-T6 tension skins and a study of the consequences for designing load sequences for testing new aircraft are discussed. The results of investigations concerning the fatigue strength of riveted, bolted, and adhesive-bonded aluminum alloy specimens are reported. Fatigue test data on specific aluminum alloys, 2024 in tempers T3 and T8 and 7178-T6, are given. Fatigue crack propagation studies on aluminum alloy specimens are reviewed, including the application of the stress intensity factor to the growth of microcracks, the effect on crack propagation of indoor and outdoor testing, of air and water, and of loading frequency, and comparisons of crack propagation rates in 2024-T3 alclad sheet from different manufacturers. A summary is given of research data concerning factors affecting the residual static strength of aluminum alloy specimens, with regard to manufacture, loading rate, and width and thickness of the sheet. Graphical representations of the study results are included.
P.A.B.

N69-21584# Royal Aircraft Establishment, Farnborough (England).
A REVIEW OF THE WORK IN THE UNITED KINGDOM ON THE FATIGUE OF AIRCRAFT STRUCTURES DURING THE PERIOD MAY 1965 TO APRIL 1967
P. D. Adams, comp. and E. L. Ripley, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 137–173 refs (See N69-21581 10-02)
(RAE-TM-Struct-691) Avail: CFSTI

The Concord test program is discussed in terms of research on room temperature fatigue, creep and overaging, the effects of their interactions on fatigue properties, and the further effects of induced thermal stresses. The status of major structural component testing is reported. Fatigue loading research is reviewed, including data from atmospheric turbulence investigations, flight load measurements, and the civil aircraft airworthiness data recording program. Fatigue studies on crack propagation, residual strength and fracture toughness, pressure vessels, cumulative damage, damage monitoring, bolts, a new Al–Zn–Mg alloy, fretting-fatigue strength, and basic mechanisms of fatigue behavior are described. Design data tests on materials and structural elements are discussed. Methods of full scale testing are reported. Acoustic fatigue research is summarized, with information on loading action studies, calculations of structural response to acoustic excitation, and testing. A full bibliography is included.
P.A.B.

N69-21585# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
REVIEW OF INVESTIGATIONS ON AERONAUTICAL FATIGUE IN THE FEDERAL REPUBLIC OF GERMANY, PERIOD OF REVIEW MAY 1965 TO MARCH 1967
E. Gassner, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 175–221 refs (See N69-21581 10-02)
(LBF-S-73) Avail: CFSTI

Investigations on the fatigue strength of various heats of 18/7/5 Ni–Co–Mo maraging steel, of aluminum alloys, and of electron beam welded sheets of maraging steel are reported; chemically etched and mechanically milled test specimens are compared. The use of Taper-Lok fasteners as a means of improving fatigue life is studied. Selection of the appropriate method of analysis for a statistical evaluation of random loads is discussed; constant amplitude tests on double-shear joints are reviewed. Studies are summarized concerning the influence of spectrum shape on fatigue strength of an aluminum alloy, of galvanic cadmium plating on the fatigue strength of steel lugs, and of various rivet types on a test specimen. Comparisons are made for butt welded and notched specimens. Investigations currently in progress are reported.
P.A.B.

N69-21587*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A REVIEW OF RESEARCH ON AERONAUTICAL FATIGUE IN THE UNITED STATES, 1965–1967
Herbert F. Hardrath, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 243–293 refs (See N69-21581 10-02)
Avail: CFSTI CSCL 20L

Results of a variety of investigations are presented, with data on the research centers carrying out the different programs. Studies on fatigue crack propagation and fracture and on plastic action at notches are discussed, along with elasto-plastic stress analysis methods and efforts to define the load environment for aircraft. Crack initiation, cumulative damage, and high temperature, low cycle fatigue investigations are reported. The feasibility of utilizing an annealed foil strain gage as a fatigue damage indicator and the optimization of ordered load spectra in full scale structural fatigue tests are considered; time compression in elevated temperature fatigue testing, fatigue strength design and structural analysis, the F-100 fatigue program, and sonic fatigue research are reviewed. Studies are described concerning the mechanical–metallurgical aspects of the fatigue process, structural reliability analysis, the mechanism of stress corrosion cracking, work hardening, and surface effects. A discussion of fatigue design considerations for materials of a supersonic transport is included.
P.A.B.

N69-21588# Ministero della Difesa Aeronautica (Italy).
A REVIEW OF RECENT FATIGUE WORK IN ITALY, 1965 TO 1967
V. Villa, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 295–336 ref (See N69-21581 10-02)
Avail: CFSTI

General investigations on fatigue and flight loads are listed; helicopter and fixed-wing aircraft testing is reported. Diagrams showing the cumulative load spectra for Italian air force trainer and transport aircraft are presented. Studies in the following areas are summarized, with accompanying graphical data: corrosion fatigue behavior of Al–Mg and Al–Cu–Mg alloys, the notch factor in fatigue behavior, effect of hard anodizing aluminum alloy specimens, temperature effects on Al–Mg 5 alloy fatigue strength, fatigue behavior of specimens superficially protected with vaseline, the effect of mean stress on axial fatigue strength, and fatigue tests of an alloy at high temperatures. Cumulative damage research, fatigue gage developments, honeycomb structure testing, and studies on the effect of edge sharpness on fatigue strength, spot-welded and seam-welded joints in light alloy sheets, 7075 alloy fatigue tests, light alloy blades in the hot condition, and heat shields are discussed. A brief report on testing of the model PD-808 aircraft and the MB-326 is included.
P.A.B.

N69-21589# France. Service Technique de l'Aeronautique, Paris.
A REVIEW OF FRENCH WORK ON FATIGUE FOR THE PERIOD 1964–1966
W. Barrios, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 339–378 refs (See N69-21581 10-02)
Avail: CFSTI

A program of systematic testing for characterization of metals is described, with information on thermal treatments; preliminary, fatigue, and creep tests; toughness fracture tests on square bar specimens with fatigue crack; stress embrittlement and

physico-chemical tests. Results of toughness bending tests on square bar specimens are interpreted; composition, tensile, and fracture property data are supplied for aluminum alloys, magnesium alloys, low alloy steels, precipitation hardening steels, and titanium alloys. Fatigue tests on smooth and notched specimens are discussed, including aluminum alloy data, studies of the effects on fatigue strength of artificial aging and of rounding sharp edges, fatigue tests on titanium alloy bars at room and elevated temperatures, and test results on fiber gas polyester panels. Studies of the fatigue behavior of steel bushes cold-glued into aluminum alloy components and of fatigue crack propagation in the outer skin of a honeycomb sandwich fuselage are examined. Recent work on fatigue damage is summarized. P.A.B.

N69-21590# Aeronautical Research Inst. of Sweden, Stockholm.
REVIEW OF SOME SWEDISH INVESTIGATIONS ON FATIGUE DURING THE PERIOD JUNE 1965 TO MARCH 1967
G. Wallgren, comp. *In* Dept. of Supply Intern. Comm. on Aeron. Fatigue Feb. 1968 p 381–404 ref (See N69-21581 10-02)
Avail: CFSTI

Results of fatigue tests on a vacuum melt 5 percent Cr-steel, a 12 percent Cr-steel, and an age hardening steel are reported. Studies are described concerning the effect of cold working by rolling and by shot peening on the fatigue strength of high strength steels. Specific efforts to increase the fatigue strength of the root part of turbine blades by shot peening are discussed. Investigations on the fatigue properties of riveted joints and the fatigue strength of lugs are summarized. The report includes full graphical representations of research data. P.A.B.

N69-21591# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.
A REVIEW OF AUSTRALIAN INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD APRIL 1965 TO MARCH 1967
J. Y. Mann, comp. *In its* Intern. Comm. on Aeron. Fatigue Feb. 1968 p 407–427 refs (See N69-21581 10-02)
Avail: CFSTI

Investigations of materials included studies on silver-containing Al–Zn–Mg alloys, the relationship between fatigue behavior and aged structure, the S/N curve discontinuity phenomenon, axial load fatigue properties of extruded aluminum alloys, batch to batch variation, statistical properties of fatigue data, and cumulative damage. Fatigue research is summarized for pin joints, riveted joints, welded Cr–Mo steel tubing, and skin-spar boom fastening methods. The DH-104 Dove mainplane, DH-115 Vampire wings, Cessna 180 mainplane, and Mirage 3 fatigue tests are discussed. Reliability and residual strength studies are reported. Kinetic heating research, on heat transfer in a fabricated structure and shear webs under transient heating, is reviewed. Flight load investigations are described for public transport, agricultural, and military aircraft; atmospheric turbulence and instrumentation studies are included. Fatigue problems in service are discussed, with regard to light aircraft fatigue, aircraft control cables, Sabre failures, and economic problems. The development of a random noise fatigue machine and test results concerning initial loading rate effects in fatigue testing are reported. P.A.B.

N69-21642 National Aerospace Laboratory, Amsterdam (Netherlands).
THE EFFECTS OF ENVIRONMENT AND LOAD FREQUENCY ON THE CRACK PROPAGATION LAW FOR MACRO FATIQUE CRACK GROWTH IN ALUMINUM ALLOYS
A. Hartmen and J. Schijve 1968 22 p refs
(NLR-MP-68001-U); Avail: CFSTI

Data are presented for fatigue crack propagation of two aluminum alloys (2024-T3 Alclad–7075-T6 clad) in different environments and for several loading frequencies. It was tried to correlate the data by the stress-intensity factor, by application of the equation for crack growth proposed by Forman. It proved that the influence of the stress ratio on the crack growth was predicted by the equation in agreement with the test results, but that the effects of the environment and the load frequency could not be coped with by changes in the constants of the equation. There may be a threshold level of the stress-intensity factor, strongly dependent on the environment and the alloy, in order to make the crack grow. Author

N69-21650# Southampton Univ. (England). Institute of Sound and Vibration Research.
VIBRATION OF CONTAINING STRUCTURES BY SOUND IN THE CONTAINED FLUID
F. J. Fahy Nov. 1968 52 p refs
(ISVR-TR-11) Avail: CFSTI

A system which consists of a rigid rectangular box with one simply supported flexible wall is analyzed by numerical and statistical methods for the internal acousto-structural mode coupling factors and the corresponding modal average radiation efficiency. It is found that for sub-critical frequencies, but above a frequency which corresponds to the lower limit for maximum proximate mode coupling, the radiation efficiency is equal to that of a baffled panel radiating into a free field. At super-critical frequencies a value of radiation efficiency half that of a freely radiating panel is found. Below the limiting frequency the radiation efficiency has been found experimentally to fall significantly below the free field value. Theory based upon the coupling between modes having non-proximate natural frequencies can explain this behavior. The radiation efficiency of a clamped panel is calculated to be about 5 db greater than that of the simply supported panel at low frequencies. This factor falls to zero at the critical frequency and above. Author

N69-21670# Technische Hochschule Munchen (West Germany).
STRENGTH PROPERTIES OF NOTCHED AND UNNOTCHED SPECIMENS UNDER VIBRATORY LOADS AS FUNCTION OF MATERIAL AND GRAIN STRUCTURE [UEBER DAS DAUERSCHWINGFESTIGKEITSVERHALTEN GEKERBTER UND UNGEKERBTER PROBEN IN ABHAENGIGKEIT VON WERKSTOFF UND GEFUEGEZUSTAND]
Erwin Teubl (Ph.D. Thesis) 1968 129 p refs In GERMAN
Avail: CFSTI

Grain and structure effects on notch sensitivity to fatigue loading were determined by correlating crystallographic measurements with stress-strain factors of micro- and macrostructure support theories. Results showed that plastic deformations developed during the initial loading phase through formation of residual linear elastic stress at the notch base. Grain structures had a pronounced effect on crack formation and crack propagation in crystals under fatigue loading; crack initiation in crystals of high orientation took place parallel to the slip bands and cracks propagated in the first region of the plane slip. Transl. by G.G.

N69-21688# Syracuse Univ., N. Y. Metallurgical Research Labs.
CRACKED COLUMNS UNDER COMPRESSION: FIXED ENDS Progress Report
H. W. Liu, Chorng-Shin Chu, and Harold Liebowitz Dec. 1968 32 p refs
(Contract Nonr-869(21))
(AD-681866; MET-E-1415-1268; PR-10) Avail: CFSTI CSCL 20/11

The deflection, the load carrying capacity, the stress intensity factor, and the fracture load of a slender column with fixed ends

have been calculated. The column has a single-edge crack at the mid-section and it has an initial deflection. A crack reduces the flexural rigidity of a column. It increases the lateral deflection and decreases the load carrying capacity of a column. The lateral deflection at the cracked section increases the bending moment there, thereby it increases the stress intensity factor and decreases the fracture load. Author (TAB)

N69-21701 National Aerospace Laboratory, Amsterdam (Netherlands).
THE EFFECT OF INTERMETALLIC PARTICLES ON FATIQUE CRACK PROPAGATION IN ALUMINUM ALLOYS
D. Broek Aug. 1968 19 p refs Presented at 2nd Intern. Conf. on Fracture, Brighton, England, Apr. 1969
(NLR-MP-68009-U) Avail: CFSTI

Electron fractography of fatigue in aluminum alloys has shown that intermetallic particles and inclusions have no significant effect on crack growth when propagation rates are low. In most cases crack growth occurs along the interface between the particle and the matrix, small particles being pulled out of the matrix. Foreign particles tend to have an influence at high growth rates, because they induce small amounts of ductile tearing. However, the true fatigue crack propagation rate is still low. This explains certain deviations from Paris' crack propagation law. Some secundary effects of inclusions, of interest for service failure analysis, are briefly discussed. Author

N69-21719# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF THE COLLISION OF METALLIC BODIES BASED ON A MODEL COMPRESSIBLE FLUID
A. N. Maryamov Mar. 1968 9 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 2, 1967 p 83-85
(AD-681621; FTD-HT-23-203-68) Avail: CFSTI CSCL 20/11

The document determines the stationary collision characteristics between metallic bodies under the assumption that the metal behaves under stress like a two-dimensional liquid, and under the assumption that both colliding bodies are compressible. A system of differential equations is derived describing the velocity components, the pressure, the density, and entropy, and the shock wave propagation in the two bodies. TAB

N69-21803# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LARGE DEPRESSIONS OF SLANTED SHELLS OF ROTATION WITH ZERO BEND RIGIDITY UNDER THE EFFECT OF UNIFORM INTERNAL PRESSURE
A. V. Sachenkov et al Jul. 1968 13 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 2, 1964 p 71-78
(AD-681810; FTD-HT-23-91-68) Avail: CFSTI CSCL 20/11

The problem of an ultracritical state of slanted rotation shells with a zero bend rigidity and considering large depressions was examined. For the solution of this problem the authors used the consecutive approximation method and accepted the deformed surface of the isometric as the zero approximation. The suggested method was applied to studies of spherical and conical shells affected by inside pressure. A comparison of the data obtained with that provided by other authors showed that a precise solution was already obtained with the second approximation. Author (TAB)

N69-21814*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF ULTRASONIC VIBRATION ON PRECIPITATION HARDENING OF STEELS AND SUPERALLOYS
Stanley G. Young and L. Leonard (Case Western Reserve Univ., Cleveland) Washington Mar. 1969 38 p refs
(NASA-TN-D-5131) Avail: CFSTI CSCL 11F

Specimens of a 300 grade maraging steel, 17-4PH steel, A-286, Rene 41, and L-605 were subjected to ultrasonic vibration during aging. Ultrasonic vibration increased the hardening rate but did not increase the maximum hardness above that of statically aged specimens. The heat treating environment (which included sodium, chloride salts, and air) was found to influence the observed hardening rates of vibrated aged specimens. Author

N69-21823# Royal Inst. of Tech., Stockholm (Sweden).
THE APPLICATION OF THE UPPER BOUND THEOREM TO THE PREDICTION OF INDENTING AND COMPRESSING LOADS FOR CIRCULAR AND RECTANGULAR DISC
Shyam Kinkar Samanta 1968 39 p refs *Its* Acta Polytech. Scand., Mech. Eng. Ser. 38
(PB-180790) Avail: CFSTI CSCL 13H

The theorem developed by Drucker, Prager and Greenberg determines upper bounds for the limit load of a supported rigid-plastic body subjected to external loads. By applying this limit load theorem to certain metal-working problems, the pressure required for such operations may be obtained, and these pressures may be exceeded by a narrow margin. Exapmles of such solutions are given. Calculations of the upper bounds based on admissible velocity fields are presented in examples of indentation and compression of circular and rectangular discs. The solutions presented give an insight into the mechanics of certain metal-working operations. Author (USGRDR)

N69-21828# Army Natick Labs., Mass.
APPROXIMATE ANALYSIS OF A FLAT, CIRCULAR PARACHUTE IN STEADY DESCENT
Edward W. Ross, Jr. Dec. 1968 52 p refs
(AD-681880; TR-69-51-OSD) Avail: CFSTI CSCL 1/3

A theory is presented for the stress analysis of a flat, circular parachute in steady, vertical descent. Unlike previous treatments of the problem, this theory does not assume that the shape is known. Instead the theory presents relations between the pressure distribution in the opened condition and the shape, drag and stresses in lines and fabric. The theory results in a non-linear third order system of ordinary differential equations with boundary conditions at both vent and skirt. This system was solved by a computer program based on the Runge-Kutta method of numerical integration. The results are in fairly good agreement with measurements on parachutes. The computer program can be used for studies of effects of design changes on shape, drag and stress, and the results of a small study of this sort are included. Author (TAB)

N69-21847*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.
AMPLITUDES OF THE STEADY FLUTTER OF CLAMPED PANELS [AMPLITUDY USTANOVIVSHEGOSYA FLATTERA ZASHCHEMLENNYKH PANELEY]
B. P. Makarov Washington NASA Mar. 1969 20 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), No. 5, 1961 p 11-25
(Contract NASw-1692)
(NASA-TT-F-12315) Avail: CFSTI CSCL 20K

Nonlinear flutter of clamped panels in a supersonic gas flow is discussed. A comparison of results corresponding to different degrees of approximation is given. The case of a plate clamped

over the surface is examined, as is that of a plate supported on two sides perpendicular to the direction of the flow and clamped on the other two sides. Author

N69-21868# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
STOCHASTIC FAILURE MODELS BASED UPON DISTRIBUTIONS OF STRESS PEAKS
R. L. Patterson Dec. 1968 283 p refs
(Contract DAHC04-68-C-0002)
(AD-681947; THEMIS-UF-TR-3; AROD-T-1-16-ET) Avail: CFSTI CSCL 14/4

The paper describes a family of time dependent random processes which can provide a tool for modeling a stress process in one spatial dimension. Probability distributions of peak stress intensity and functions of peak stress intensity occurring in a fixed time interval are developed. A family of first passage times are interpreted as life length distributions and their mean and variance are derived in terms of parameters of the underlying process. Author (TAB)

N69-21911# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
GEM: GENERAL MATRIX MANIPULATION PROGRAM
R. L. Fagan and R. B. McCalley 18 Mar. 1968 103 p refs Sponsored by AEC
(PB-180827; KAPL-M-6735; EC-67) Avail: CFSTI CSCL 20K

GEM, General Matrix Manipulation with VEP (Vibration Eigenvalue Problem) and SHO (SHOCK) can be used to solve many problems involving general matrix operations. This program is intended primarily to perform vibration studies with the capability of generating input for the VEP routine and performing additional operation on the output from SHO. VEP calculates the natural frequencies and mode shapes of a given springmass system of up to 60 degrees of fredom. This system is defined by mass and stiffness matrices. Given the mode shapes, frequencies, and mass of a vibrating system, the SHO routine computes deflections and forces at the mass points. Author (USGRDR)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-20751 Case Western Reserve Univ., Cleveland, Ohio.
ON LYAPUNOV'S SECOND METHOD AND IRREVERSIBLE THERMODYNAMICS
H. Ted Huddleston, Jr. (Ph.D. Thesis) 1967 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-10165

The application of thermodynamic information to the generation of Lyapunov Functions has been investigated. Initial results indicate that the internal entropy production expression and a related function, the Thermokinetic Potential, are useful Lyapunov Functions for the stability analysis of both lumped parameter and distributed parameter systems. The physical systems considered are open and undergo heat, mass, and momentum transfer, and chemical reaction. From thermodynamic analysis, the internal entropy production expression can be obtained explicitly, but the more useful Thermokinetic Potential must be integrated from a sign definite differential. Dissert. Abstr.

N69-20776*# Bliss (E. W.), Co., Swarthmore, Pa. Research and Development Div.
EVALUATION OF HIGH EXPANSION FOAM FOR SPACECRAFT FIRE EXTINGUISHMENT
R. J. Charno 3 Feb. 1969 110 p
(Contract NAS9-7983)
(NASA-CR-99580) Avail: CFSTI CSCL 13L

The problem was to demonstrate the feasibility of using high expansion foam to extinguish a model fire of dry cellular fuel inside an oxygen rich enclosure at various spacecraft operating pressures. This problem was solved by assembling a 400 cubic foot hypo/hyperbaric fire test facility in which a 12 inch by 12 inch by 2 inch high opened celled foamed polyurethane fuel specimen, or a cotton twill laboratory smock fuel specimen could be burned in air; 95% Oxygen; 70% Oxygen–30% Helium; and 50% Oxygen–50% Nitrogen environments at 5, 10, 14.7 and 16.5 psia. Author

N69-20799 Michigan Univ., Ann Arbor.
BUBBLE GROWTH ON A GLASS SURFACE DURING BOILING OF ETHYL ALCOHOL AND TOLUENE
Thomas Irving McSweeney (Ph.D. Thesis) 1968 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-13363

A study of boiling heat transfer on a glass surface was undertaken to determine the boiling characteristics of ethyl alcohol and toluene and to estimate the contribution of microlayer vaporization to both the overall heat transfer rate and the amount of energy in a departing bubble. An experimental procedure was developed utilizing thin-film circuitry on the boiling surface, the single site heater, an electronic synchronization between photographs of the boiling process and temperature traces displayed on an oscilloscope. The use of the single nucleating site is an excellent method for the study of the boiling process. For instance, the base contact radius, which has been previously neglected and yet was found to be an important parameter, is easily observed. A theory of microlayer formation, based on experimentally determined bubble growth rate, was developed in the course of this investigation which successfully explains the phenomena associated with the boiling of ethyl alcohol and toluene. Dissert. Abstr.

N69-20882*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASURED EFFECTS OF GASEOUS FLOW SYSTEM DYNAMICS ON ACOUSTIC-MODE COMBUSTION INSTABILITY
John F. Groeneweg Washington Mar. 1969 17 p refs
(NASA-TN-D-5080) Avail: CFSTI CSCL 21B

Experiments in which hydrogen injection geometry was changed in a T-burner combustor demonstrated that hydrogen flow system dynamics can influence acoustic-mode instability. Stability boundaries for the combustor were shifted by changing the hydrogen manifold volume and by changing the amount of propellant stream interaction. The results were compatible with stability boundaries calculated from a combustor response model if the time delay, which was assumed to exist between injection and combustion of the hydrogen, varied with propellant flow rates. Author

N69-20951 Wisconsin Univ., Madison.
HEAT TRANSFER AND FLOW CHARACTERISTICS IN CONDUCTIVE POROUS MEDIA WITH ENERGY GENERATION
Wasi Uddin Choudhury (Ph.D. Thesis) 1968 247 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-9069

A theoretical study was performed, based on the formulation and solution of the pair of coupled, linear partial differential equations governing the transient heat transfer in a one-dimensional porous medium with a uniform internal energy source. Finite thermal conductivities of the solid and the fluid phases were investigated. An experimental study was made to determine the measurements of the volumetric heat transfer coefficient, pressure drop, and friction factor between air and porous metallic specimens by a transient method. As a practical application of the results obtained, the use of porous fuel elements in the nuclear reactor was considered. Some calculations have been made to show that the porous fuel elements may provide more power than the conventional solid fuel elements used at the present time. Dissert. Abstr.

N69-20959 Illinois Univ., Urbana.
EXPERIMENTAL OBSERVATIONS ON THERMAL CONVECTION IN CONFINED GAS LAYERS
Douglas Steven Prensner (Ph.D. Thesis) 1968 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-12182

A study was made of thermal convection in a completely confined, horizontal gas layer heated from below and cooled above. The enclosures used were cylinders of various h/R values. The non-convective, convective, oscillatory, and turbulent states of the gas layer were investigated using visual smoke techniques, temperature probes, and heat flux measurements. The effects of the h/R values on the various onsets, transitions, and flow patterns were observed. Helium and air were the gases studied. Basic flow patterns and transitions between them were seen in four cells whose h/R values were chosen from Pellew and Southwell's theory. Oscillating toroidal flow was observed. The onset and termination of oscillatory flow was found to be affected unpredictably by rate and direction of approach to the state, and by thermal and mechanical jarring. The onset to oscillatory flow appeared to be quite metastable. Dissert. Abstr.

N69-20971 Oregon State Univ., Corvallis.
AN EXPERIMENTAL INVESTIGATION OF COMBUSTION PRODUCTS THROUGH A FLAT, LAMINAR, PREMIXED HYDROCARBON-AIR FLAME
David Lee Brenchley (Ph.D. Thesis) 1968 202 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-11911

Flat, laminar, premixed hydrocarbon-air flames were stabilized on a porous-plate burner. In addition to temperature profiles, concentration profiles were measured for methane, ethane, ethylene, propane, acetylene, propylene, carbon monoxide, carbon dioxide and oxides of nitrogen. Dead space thickness, luminous flame zone thickness and hydrocarbon disappearance point responses were also monitored. The experimental parameters investigated were hydrocarbon fuel type: propane and propylene; equivalence ratio: .90 to 1.10; plate temperature: 600°F to 800°F; and sampling position: .005 to .335 cm. A completely randomized nonreplicated factorial experiment was used to statistically detect the presence of main and two-factor interaction effects. Higher order three and four-factor interaction terms were pooled as an estimate of the error term. Dissert. Abstr.

N69-20972 Texas Univ., Austin.
NATURAL CONVECTION HEAT TRANSFER BETWEEN CONCENTRIC SPHERES
Robert James Brown (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-10815

The problem of transient natural convection heat transfer between isothermal concentric spheres was solved numerically. The three coupled partial differential equations which describe the heat transfer are those for vorticity and temperature and the stream function-vorticity relation. The first two are parabolic equations which, largely because of the nonlinear boundary conditions on the vorticity, were solved by an explicit finite-difference technique; the stream function-vorticity relation, an elliptic equation, was solved by successive over-relaxation. The equations were solved to obtain velocity, temperature, and stream function fields for various values of three independent dimensionless parameters: the Rayleigh number, the Prandtl number, and the diameter ratio. Nusselt numbers were then obtained from the calculated temperature fields. Dissert. Abstr.

N69-20986*# Stanford Research Inst., Menlo Park, Calif.
A THEORETICAL AND EXPERIMENTAL STUDY OF PROPELLANT COMBUSTION PHENOMENA DURING RAPID DEPRESSURIZATION Final Report
C. E. Wooldridge, G. A. Marzman, and R. J. Kier 15 Feb. 1969 167 p refs
(Contract NAS1-7349)
(NASA-CR-66733) Avail: CFSTI CSCL 21B

This report presents a modification of a solid propellant transient combustion model developed earlier by the authors, designed to account for the observed steady-state behavior of both burning rate and flame temperature in real propellants. The model is applied to large excursions of the environmental pressure, both upward and downward. The results are compared to experimental data obtained from both pressurization and depressurization tests. It is shown that the burning rate response predicted by the model is somewhat larger than that observed experimentally. Author

N69-21044*# TRW Systems Group, Houston, Tex.
DEVELOPMENT OF DIGITAL COMPUTER PROGRAM FOR THERMAL NETWORK CORRECTION. PHASE 1: INVESTIGATION/FEASIBILITY STUDY Final Report
T. Ishimoto, H. M. Pan, J. D. Gaski, and E. B. Stear Jan. 1969 141 p refs
(Contract NAS9-8289)
(NASA-CR-99599; TRW-11027-6001-RP-00) Avail: CFSTI CSCL 20M

An investigation/feasibility study period is presented whereby the feasibility of analytical error analysis as applied to thermal network solutions is established. A literature search revealed two basic classes of correlation methods, one-pass and sequential. Within the framework of each class are numerous variations, each suited for specific requirements. A number of potentially suitable correlation methods selected from a list of techniques reported in literature were studied and screened, resulting in the selection of five methods for further study. These methods were: (1) kalman filter; (2) program MAFIA; (3) quasilinearization; (4) least squares with net heat flux residual; and (5) regression analysis. The latter two were studied to obtain baseline information. Author

N69-21075 Washington State Univ., Pullman.
EFFECT OF FREE ELECTRON CONCENTRATION ON THE THERMODYNAMIC ACTIVITY OF ZINC IN SILVER-ZINC ALLOYS

Jerry Lee Straalsund (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-10974

A dew-point technique was used to determine the thermodynamic activity of zinc at 703°K in a series of ε-phase silver–zinc binary alloys and ternary alloys with small additions of aluminum and palladium. The composition of the alloys ranged from 72 to 88 atomic zinc percentage. The data are presented in the form of graphs. Equations are presented to demonstrate that the thermodynamic activity can be related to the density of states of the conduction electrons, and that the observed phenomena are consistent with this model. The data seem to indicate that zone overlap has caused a spinodal point, and the resulting miscibility gap, in the phase diagram. Dissert. Abstr.

N69-21221# State Inst. for Technical Research, Helsinki (Finland).
ON A STATIC COMPARATIVE METHOD FOR MEASURING THE THERMAL CONDUCTIVITY OF GOOD THERMAL CONDUCTORS
V. Kelhae and D. O. Riska 1968 19 p refs
Avail: CFSTI

In this method, a comparison is made between the conductivity of a metal and that of Armco iron. The Armco was selected as the standard, as previous measurement as established its conductivity within fairly close limits. Determinations are made by measuring the axial temperature gradients in two cylindrical bars, pressed together, with one end of the system heated. The heat flow in the bars and the surrounding insulation layer is analyzed, and the accuracy of the measurements calculated by the application of an approximate method. The accuracy can be improved by choosing an optimal external temperature distribution, devised in the paper. The optimal condition is achieved when the external temperature gradient is equal to the gradient in the sample bar. Author

N69-21246# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
ANALYTICAL EXPRESSIONS FOR THE THERMODYNAMIC PROPERTIES OF DEFENSE NITROGEN
S. Culotta and K. R. Enkenhus Sep. 1968 52 p refs
(VKI-TN-50) Avail: CFSTI

Analytical expressions are given for the thermodynamic properties of undissociated dense nitrogen. These properties, which include the internal energy, enthalpy, entropy, compressibility, sound speed and specific heats, are obtained with the help of the equation of state using thermodynamic relations. The equations are expressed in terms of reduced variables, that is, the pressure, density and temperature are made dimensionless by dividing by the corresponding values at the critical point. The constants appearing in the equations of state were selected to provide the best agreement of the resulting thermodynamic properties with the AEDC tables for dense nitrogen. The analytical expressions for the thermodynamic properties of nitrogen agree with the AEDC tables within better than one percent on the average at all densities up to 1000 amagats and temperatures from 300°K to 5000°K. Author

N69-21256# Brown Engineering Co., Inc., Huntsville, Ala. Advanced Systems and Technologies Group.
GENERALIZED NUMERICAL SOLUTION OF TRANSIENT HEAT CONDUCTION IN A MULTILAYER HOLLOW CYLINDER
J. L. Thurman Jan. 1969 55 p refs
(AST-288) Avail: Issuing Activity

Finite difference equations are derived and a FORTRAN digital computer program (SP-303) is described for calculating the transient, radial temperature distribution in a multilayer hollow cylinder, with internal heat generation, subject to several possible axisymmetric boundary conditions. Up to four layers of different materials may be accommodated. Thermal properties are assumed to be constant. A nonuniform initial temperature profile may be treated. Two illustrative problems are solved to demonstrate the utility of the computer program. Operating instructions and a FORTRAN listing of the program are included. Author

N69-21273# Applicazioni e Ricerche Scientifiche, Milan (Italy).
A THEORETICAL ANALYSIS OF SOME MODELS FOR STEADY BURNOUT Final Report
L. Biasi, G. C. Clerici, R. Sala, S. Garribba (CESNEF.), and A. Tozzi
Brussels EURATOM 1968 164 p refs
(Contract EURATOM-106-66-12-TEEI)
(EUR-3800.e; EURAEC-2025) Avail: CFSTI

The heat transfer crisis in circular ducts with positive quality at the outlet is studied. Two different approaches were followed. The former consists of a theoretical study on the liquid film flow-rate under heat transfer conditions, with the aim of predicting the film dry out. The latter is based on the examination of the experimental burnout data with the goal of correlating them by means of a simple analytical expression. A collection of burnout data with nonuniform heating is reported. Author

N69-21311# European Space Research and Technology Centre, Noordwijk (Netherlands).
THE THERMAL BALANCE OF SPHERES IN A 75-cm DIAMETER TEST CHAMBER
E. W. V. Acton Paris ESRO Oct. 1968 36 p refs
(ESRO-TN-33-ESTEC) Avail: CFSTI

Experiments were carried out in the small spherical heat balance chamber to verify equations describing the thermal behaviour of spheres held central in the shroud. The spheres had polished nickel, polished aluminum, and black painted surfaces; they were heated both electrically from inside and by carbon arc and xenon arc lamp from outside. The shroud was cooled both by mains water and liquid nitrogen with similar results on heat balance. The possible use of water cooling for some tests in large chambers was suggested following these experiments. A method was found and used to determine empirically the amount of regular reflection present in the test chamber from a mixture of diffuse and regular reflection; the equations were applied both to the transient and steady-state cases. The work described in this document refers to the sphere and shroud being treated as isothermal units. Author (ESRO)

N69-21389# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
VELOCITY MEASUREMENTS FOR SHOCK AND DETONATION WAVES [DE METING VAN SCHOKGOLF EN DETONATIE SNELHEDEN]
30 Sep. 1968 32 p refs In DUTCH
(TL-1968-13; (TDCK-51993III) Avail: CFSTI

Methods presently used for measuring detonation velocities are reviewed, stressing especially the measurement of continuum waves by optical methods, use of the Doppler effect, use of the ionization of the reaction zone, and use of the high pressure in the reaction zone. The measurements are helpful in determining where and how a stationary condition has occurred in the explosive. The conditions conducive to detonation of the explosive can also be determined with this method, particularly if the explosive contains ammonium nitrate. Accuracies to within 5 to 10% have been obtained with these methods. By combining the continuum and the discontinuity measurements, the error in the velocity determination can be reduced to 2%. Transl. by K.W.

N69-21394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF HEAT EXCHANGE ON RELATIVISTIC FLUID FLOW
L. A. Schmid Apr. 1969 77 p refs
(NASA-TM-X-63499; X-641-69-118) Avail: CFSTI CSCL 20M

The established covariant formalism of relativistic fluid dynamics is used as a framework on which to construct a formalism for relativistic thermodynamics. The formalism is developed for the case of adiabatic flow of an ideal compressible fluid. By mathematical manipulation, a variational formulation is arrived at without the need of physical postulates. The case of two coexisting ideal fluids in reversible thermal contact with each other is described by modifying the constraint that conserves the entropy flux of a single fluid. The form of the Euler equation for the two fluids that results from the variational formalism shows that a four-vector description of temperature is best suited to the needs of relativistic fluid dynamics. The physical aspects of the heat transfer between the two fluids, especially the reversibility condition, are explained in terms of a relativistic Carnot cycle between each of the fluids.
B.G.D.

N69-21397# Centre National de la Recherche Scientifique, Meudon (France).
REMARKS ON RELATIVISTIC THERMODYNAMICS
Remi Hakim and Andre Mangeney Jan. 1969 17 p refs
(PM/69/1) Avail: CFSTI

With the help of relativistic statistical mechanics, it is shown that the notion of temperature of a relativistic gas is not free from ambiguities. Accordingly several possible transformation laws are equally valid. Furthermore it seems that the quantity actually measured is the proper temperature. The transformation properties of internal energy are also discussed.
Author

N69-21407# Council for Scientific and Industrial Research, Pretoria (South Africa).
HEAT TRANSFER IN TURBULENT GAS FLOW IN ANNULAR TUBES [TEPLOOTDACHA PRI TURBULENTNOM TECHENII GAZA W TRUBAKH KOL'TSEVOGO SECHENIIA]
B. S. Petukhov et al 1968 21 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 1, 1967 p 103–112
(Ref-688) Avail: CFSTI

Tests were carried out on tubes with a d_{w1}/d_{w2} (w = wall) diameter ratio of 0.07–0.84 for an Re range of 10^4 (sic) to $3 \cdot 10^5$. Interpolated equations are proposed for the calculation of heat transfer at arbitrary ratios of heat flux densities on the walls.
Author

N69-21413# Technologisch Lab. RVO-TNO, Rijswijk (Netherlands).
THE IGNITION OF GUNPOWDER, FIRST-PART REPORT [DE ONTBRANDING VAN KRUIT, EERSTE DEELVERSLAG]
26 Jul. 1968 25 p refs In DUTCH
(TL-1968-4; TDCK-51424III) Avail: CFSTI

Ignition times of two nitroglycerin explosives were measured under controlled conditions. The explosives, in the form of small cylinders, were inserted into a hot gas stream of nitrogen and air. The gas flow velocity was varied between 3 and 11 m/s, the temperature between 280° and 530°C. This resulted in a heat flux density at the surface of the explosives of 10^5 to $3 \cdot 10^5$ W/m^2 and in corresponding ignition times of 13 to 1.5 s. The results indicate that the ignition time is chiefly determined by the heat flux near the surface of the explosive, while the effect of the oxygen contents in the hot gas flow is negligible.
Transl. by K.W.

N69-21537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECTIVENESS OF CYCLES, USED FOR HELIUM LIQUEFACTION
I. B. Danilov May 1968 20 p refs Transl. into ENGLISH from Khim. Mashinostr. (Moscow), no. 2, 1964 p 5–9
(AD-681692; FTD-MT-24-38-68) Avail: CFSTI CSCL 7/1

A comparative theoretical study is presented of various cycles used for the liquefaction of helium. Following the design and construction of a reliable piston refrigeration unit for helium such cycles became important in practice. Consequently, the author discusses a cycle using liquid nitrogen and a cascade piston unit without outside coolants. The usefulness of the nitrogen-cooled cycle depends on the cost and availability of liquid nitrogen since its consumption is quite high (0.8 liters of nitrogen for each liter of liquid helium, not including auxiliary needs from helium Dewar bottles, etc.). The cascade cycle unit seems to be much more promising (liquid nitrogen is used here only as an auxiliary coolant), and a good efficiency is found even with a two-piston unit; a three piston unit improves the efficiency by 20-40%. The hydrogen-cooled pistonless devices are 1.5 times less efficient than the other two devices. However, the hydrogen-cooled devices will most probably remain widely used wherever liquid hydrogen is already used for other purposes.
Author (TAB)

N69-21613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF CRITICAL HEAT FLUXES DURING SURFACE BOILING OF ORGANIC LIQUID IN TUBES
L. S. Sternman et al 14 Jun. 1968 13 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh., Akad. Nauk Belorussk SSR (Minsk), v. 7, no. 2, 1964 p 10–14
(AD-681808; FTD-MT-24-146-68) Avail: CFSTI CSCL 20/13

The choice of heat fluxes in newly designed devices cannot be accomplished without knowing the magnitudes of the critical heat fluxes. Most of the existing quantitative relationships are based on data from experiments with water, studies of organic carriers are not very numerous. The present experiment used the procedures and experimental devices described earlier by the authors and studied 95.6-96.0% pure ethyl alcohol. An analysis of the various results shows that within the investigated range of values the size of the tube does not affect the magnitudes of the critical heat flux. It is also found that none of the formulas proposed by various Soviet authors can be used for the determination of the critical flux values for the surface boiling of ethyl alcohol in tubes.
TAB

N69-21704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW METHODS IN THE COMBUSTION OF FUELS AND PROBLEMS IN THE THEORY OF COMBUSTION
V. M. Ivanov et al Jul. 1968 24 p refs Transl. into ENGLISH from the Monograph "Novye Metody Szhiganiya Topliv i Voprosy Teorii Goreniya" Moscow, Nauka, 1965 p 146–161
(AD-681690; FTD-MT-24-198-68) Avail: CFSTI CSCL 21/2

As a part of the program of comprehensive studies of combustion and heat transfer at high pressures, an experimental investigation was made of diesel fuel combustion under 8 atm of air and up to 50 atm of oxygen-steam. The experiments were conducted in two combustion chambers with diameters of 0.22 and 0.32 and lengths of 1.65 and 2 m. The length of the combustion zone was determined as a function of the air excess factor and pressure. A previously derived formula for calculating the length of the combustion zone as a function of the air excess factor, flow velocity, and fuel density was found to give results in good agreement with the experiments. Temperature, velocity, and concentration profiles and heat transfer coefficients were also obtained.
Author (TAB)

N69-21716# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

APPROXIMATE SOLUTION OF NONSTATIONARY PROBLEMS OF HEAT-CONDUCTION THEORY WITH ALLOWANCE FOR THE EFFECT OF THE TEMPERATURE DEPENCENCE OF THE THERMOPHYSICAL PROPERTIES ON THE BASIS OF B. G. GALERKIN'S METHOD

M. G. Kaganer Aug. 1968 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 2, 1968 p 48–51

(Contract NOw 62-0604)

(AD-681780; APL-CLB-3-T-561) Avail: CFSTI CSCL 20/13

A method is proposed for the approximate solution of a quasilinear heat-conduction equation. It is based on approximation of the temperature field by a system of functions obtained by exact solution of the same boundary problem in the case of constant thermophysical properties. The undetermined coefficients of this system are sought by Galerkins method. The solutions of two boundary problems for an infinite plate are presented as examples of application of the proposed method. The approximate solution obtained is compared with the results of numerical calculation on an electronic computer. Author (TAB)

N69-21744# Technische Hochschule Munchen (West Germany).

COMBUSTION PROBLEMS DURING PARTIAL LOAD OPERATION OF THE TWO-CYCLE OTTO ENGINES WITH CRANKCASE SCAVENGING [BEITRAG ZUR KLAERUNG VON VERBRENNUNGSPROBLEMEN BEI TEILLAST KURBELKASTEN-GESPUELTER ZWEITAKT-OTTOMOTOREN]

Karl Bauer (Ph.D. Thesis) 1968 212 p refs In GERMAN

Avail: CFSTI

Abnormal combustion and knocking in two-stroke cycle gasoline engines during partial load operation was improved by vent opening to increase the mixing air flow. This method improved ignition probability by 100% for an initial output of 20%. Comparison of idling settings with various ignition timings through exhaust gas analyses established that the higher ignition timings did not result in an increase of ejected carbon monoxide and hydrocarbons. Delayed ignition timings and maximal revolution rates reduced the efficiency of the mechanical and acoustical idling balance and produced engine noise. Transl. by G.G.

N69-21755# California Univ., Berkeley. Div. of Applied Mechanics.

RODS, PLATES, AND SHELLS

A. E. Green (Oxford Univ.) and P. Naghdi Jan. 1969 81 p refs

(Contract N00014-67-A-0114)

(AD-682215; AM-69-1) Avail: CFSTI CSCL 13/13

A detailed development of nonlinear thermodynamical theories of rods and shells is discussed using the three dimensional theory of classical continuum mechanics as a starting point. A portion of the paper supplements and amplifies the previous work on the subject by Green, Laws and Naghdi. Special attention is given to non-isothermal linear theories of elastic shells and straight elastic rods which are derived from the three dimensional equations. Author (TAB)

N69-21785# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIATION FIELD OF THE PLANET EARTH

K. Ya. Kondratev et al Jul. 1968 332 p refs Transl. into ENGLISH from the book "Pole Izlucheniya Zemli Kak Planety" Leningrad, 1967 p 1–316

(AD-681610; FTD-MT-24-60-68) Avail: CFSTI CSCL 20/13

In the monograph results of theoretical and experimental investigations of the field of terrestrial radiation are generalized. Methods of calculations and measurements are briefly discussed. Angular spectral characteristics of outgoing emission for shortwave and long-wave radiation are thoroughly examined. A survey is made of works on the problem of radiation balance of the earth-atmosphere system. Considerable attention is given to the problem of outgoing radiation fluxes on surface of different angles. Author (TAB)

N69-21790# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMAL IONIZATION IN A FLAME AND INTENSIFICATION OF BURNING BY A FORCE FIELD

M. A. Glinkov and E. M. Stepanov Jun. 1968 18 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chem. Met. (Moscow), v. 4, no. 9, 1961 p 143–152

(AD-681605; FTD-MT-24-169-68) Avail: CFSTI CSCL 21/2

The object of the experiment was to investigate thermal ionization in a flame and to determine whether burning was intensified by the application of a force field. Natural gas is the fuel used. The stages of burning are given: primary surge; ionization; and branching chain reactions of burning. Knowing this, it can be concluded that equilibrium burning requires ionized fuel molecules or free radicals, the primary surge can be any energy form, and fuel molecules should be activated as much as possible in preparation for burning. Thermal ionization was studied at three gas-flow rates, with and without premixing of gas and air. The influence of a force field or intensity of burning was studied in experiments on the heating of blanks and a lead bath. Maximum ionization is in the immediate vicinity of maximum temperature. Maximum ionization precedes maximum temperature. Relationships are given between maximum ionization and fuel flow rate. The force field intensifies burning throughout the flame. Experiments on heating confirms conclusions drawn from experiments on thermal ionization. Author (TAB)

N69-21799# National Bureau of Standards, Boulder, Colo. Cryogenic Div.

LIQUID VAPOR AND SOLID VAPOR EQUILIBRIUM IN THE SYSTEM HYDROGEN-ETHANE

M. J. Hiza, G. K. Heck, and A. J. Kidnay Repr. from Advan. in Cryog. Eg., Proc. of the 1967 Cryog. Eng. Conf., v. 13, Aug. 1967 p 343–358 refs

(R-464; PB-180897) Avail: CFSTI CSCL 20M

The liquid-vapor and solid-vapor data up to 150 atm given here, along with the liquid-phase data below the normal boiling point of ethane and the liquid-vapor data above the normal boiling point of ethane from Williams and Katz up to 544 atm, provide a consistent set of phase equilibria data for the hydrogen-ethane system. The major discrepancy between the two sets of data occurred in the gas phase 144.26K. It is concluded, from the consistent variation with temperature of enhancement factors from the present data measured by different methods, that the gas phase data of Williams and Katz at 144.26K are too high. Author (USGRDR)

N69-21861# California Univ., Berkeley. Lawrence Radiation Lab.

HEAT OF FORMATION OF SOLID INDIUM LEAD ALLOY

Hong Il Yoon (M.S. Thesis) Sep. 1968 22 p refs

(Contract W-7405-eng-48)

(PB-180862; UCRL-18402) Avail: CFSTI CSCL 20M

The heats of formation at 315K of solid indium–lead alloys of composition X_{Pb} = 0.1 to 0.9 have been measured by means of liquid tin solution calorimetry. The alloys are endothermic, except that for the alpha-phase, the heat of formation is 0(±40) cal/g-atom. The partial molar heats of solution of In and Pb in liquid tin at 650K were also determined. Author (USGRDR)

N69-21885# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
COMBUSTION AND FLAME PROPAGATION IN HETEROGENEOUS SYSTEMS Final Report
C. Sanchez Tarifa, A. Munoz Torralbo, and P. Perez del Notario Nov. 1968 33 p refs
(Grants AF-EOAR-44-67; AF-EOAR-0027-68)
(AD-681514; AFOSR-69-0157TR) Avail: CFSTI CSCL 21/2

The research work performed during the report period has been devoted to the study of the problem of flame spreading over the surface of plastic fuels in nitrogen-oxygen mixtures. Some research work has been also performed on the problem of combustion of liquid propellants and fuels in droplet form near the critical pressure. Author (TAB)

N69-21947# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSITION OF A COMBUSTION MIXTURE FROM SUPERSONIC FLOW TO THE CHAPMAN-JOUGET REGIME
S. M. Gilinskii and Z. D. Zapryanov Jul. 1968 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidk. Gaza (USSR), no. 3, 1967 p 137–140
(AD-681597; FTD-MT-24-280-68) Avail: CFSTI CSCL 21/2

The investigation of supersonic flow about bodies by a combustion mixture of gases is of importance in studying combustion efficiency of fuel in ramjet engines. In the present study, a numerical method is presented for solving the problem of supersonic flow about a cylinder and a plate with a cylindrical bluntness. A study was also made of a possible transition to the Chapman-Jouget regime. TAB

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-20964*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.
A MACRO MODEL FOR THE EVALUATION OF THE ORDER OF MAGNITUDE OF BENEFITS FROM SPACE RESEARCH FOR THE GERMAN FEDERAL REPUBLIC [EIN MAKRO-MODELL FUR DIE ABSCHATZUNG DER GROSSENORDNUNG DES AUS DER WELTRAUMFORSCHUNG ABLEITBAREN NUTZENS FUR DIE BRD]
H. H. Koelle Washington NASA Mar. 1969 72 p Transl. into ENGLISH of the German Rept. TUB-IR-1968/4
(Contract NASw-1692)
(NASA-TT-F-12057; TUB-IR-1968/4) Avail: CFSTI CSCL 05C

Concentration of German space research is on the description of a basic model to be used for further iterations as a base to deviate from. The DELPHI method will be used to improve this model. Preliminary estimates indicate an economical benefit in the order of 2.5 billion dollars for the year 1985. The scientific and political benefits will have to be added to this and can easily double this figure. Author

N69-20988*# Battelle Memorial Inst., Columbus, Ohio.
AN ANALYSIS OF THE ALLOCATION OF FEDERAL BUDGET RESOURCES AS AN INDICATOR OF NATIONAL GOALS AND PRIORITIES, PART 2
Leonard L. Lederman and Margaret L. Windus 10 Feb. 1969 297 p refs
(Contract NASw-1146)
(NASA-CR-100436; BMI-NLVP-TR-69-1-Pt-2) Avail: CFSTI CSCL 05A

Discussed are national program areas in connection with government outlays and research and development activities. Overall goals and resources allocated are summarized and translated in a proposed Federal budget that is designed to support a total active force strength of approximately 3.5 million men and women. Considered are functional field budgets for: (1) national security; (2) welfare; (3) health; (4) commerce, transportation, and communications; (5) education and knowledge; (6) agriculture; (7) international relations; (8) labor and manpower; (9) veterans; (10) space; (11) housing and community development; (12) natural resources and environment; and (13) general government. G.G.

N69-20989*# Battelle Memorial Inst., Columbus, Ohio.
AN ANALYSIS OF THE ALLOCATION OF FEDERAL BUDGET RESOURCES AS AN INDICATOR OF NATIONAL GOALS, AND PRIORITIES, PART 1
Leonard L. Lederman and Margaret L. Windus 10 Feb. 1969 76 p refs
(Contract NASw-1146)
(NASA-CR-100435; BMI-NLVP-TR-69-1-Pt-1) Avail: CFSTI CSCL 05A

National goals and objectives are analyzed and defined in order to plan space program budgets with emphasis on allocation of Federal research and development resources. This will permit the later consideration space goals in relationship to broader national goals and objectives and more specified Federal scientific and technological activities. Concepts are based on: (1) goal oriented activities; (2) priorities among goals; and (3) analyses of past and present activities and goals that contribute to an understanding of the future. G.G.

N69-21009# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
DIFFERENTIAL GAMES: MODELING CONSIDERATIONS FOR THE SURFACE-TO-AIR MISSILE AVOIDANCE PROBLEM
J. Dunn and M. Falco Mar. 1969 65 p refs
(RE-362) Avail: Issuing Activity

Basic modeling considerations are exposed that arise in the formulation of an urgent and typically complex aerial warfare problem, viz, the surface-to-air missile (SAM) avoidance problem. Strong plausibility arguments are offered in support of the contention that realism and solvability are mutually incompatible requirements for any conventional game theoretic model of this problem, i.e., any game model which retains the essential features of the problem will not readily, if at all, result in a solution, and any single model which is simplified to the point of being solvable, in the classical sense, is likely to give solutions that are conspicuously nonoptimal in the realistic situation. Special attention is given to recent proposals to treat the SAM avoidance problem via the relatively new theory of differential games; here too, elementary physical considerations indicate the irrationality of the repeated use of tactics derived from the solutions of any solvable differential game model of the SAM problem. More specifically, it is argued that such solutions will almost certainly fail to meet, or approximate, the equilibrium characteristic required of a valid static solution of the ongoing mission-to-mission decision problem. Author

N69-21087*# New York Univ., N. Y. Graduate School of Business Administration.
SCIENTISTS, ENGINEERS AND MANAGERS: PARTNERS IN SPACE

Alex W. Rathe and Dhun Irani Dec. 1968 214 p refs
(Grant NGR-33-016-067)
(NASA-CR-100414; C-69-1) Avail: CFSTI CSCL 05A

An attempt was made to identify the major factors in management practices and attitudes, as well as their effects, which would help to obtain a better understanding of the interdependence of engineering and management in the aerospace industry. The groundwork for the analyses was laid through an extensive search of the literature. For the discussions with managers and engineers, lengthy interview guides were drafted. All material was recorded and classified by subject matter. Each of these categories was tehn subjected to creative analysis in discussions among the authors; the observations were then fitted into a comprehensive framework that accommodated all major aspects of engineering management. The results presented discuss the engineer and his work; the impact of engineering management upon such work, after a recapitulation of motivational factors; and the systems approach to management. Planning, direction of operations, review and feedback, control, personnel administration, and managerial philosophy are discussed in relation to the management of engineers. B.P.

N69-21176# Bundesministerium fuer Wissenschaftliche Forschung, Bad Godesberg (West Germany).
SYMPOSIUM ON PROJECT MANAGEMENT [SYMPOSIUM UEBER PROJEKT MANAGEMENT]
Dec. 1968 209 p Partly in ENGLISH and GERMAN Symp. held at Bad Godesberg, 14–15 Sep. 1967; sponsored jointly by BMwF and WGLR
(BMwF-FB-W-68-78) Avail: CFSTI

CONTENTS:

1. SYMPOSIUM ON PROJECT MANAGEMENT p 7–14
2. PROBLEMS OF NATIONAL POLICY RELATING TO SCIENCE AND TECHNOLOGY N. E. Golovin (Office of Sci. and Tech.) p 15–20 (See N69-21177 10-34)
3. PROJECT MANAGEMENT: WHENCE AND WHITHER? H. H. Koelle (Tech. Univ.) p 21–32 (See N69-21178 10-34)
4. ASPECTS OF MODERN PROJECT MANAGEMENT K. R. Schwenn (Lockheed Missiles and Space Co.) p 33–46 (See N69-21179 10-34)
5. GUIDE LINES AND RECOMMENDATIONS FOR SYSTEM MANAGEMENT W. Kiessling (Dornier-Werke G.m.b.H.) p 47–69 (See N69-21180 10-34)
6. MANAGEMENT OF SATELLITE PROJECTS A. B. Mickelwait and A. K. Thiel (TRW Sys.) p 70–85 (See N69-21181 10-34)
7. PROJECT MANAGEMENT FOR THE FIRST GERMAN SATELLLTE "AZUR" E. Theunissen (Bolkow Entwicklungen K. G.) p 86–99 (See N69-21182 10-34)
8. PROJECT MANAGEMENT OF EUROPEAN SATELLITES FROM THE POINT OF VIEW OF THE ORGANIZATION AWARDING THE CONTRACT H. Busch (European Space Res. and Tech. Center) p 100–132 (See N69-21183 10-34)
9. THE PROJECT MANAGEMENT OF HEOS-A AS AN EXAMPLE FOR THE DESIGN AND EXECUTION OF A EUROPEAN SATELLITE J. Henrici (Junkers Flugzeug- und Motorenwerke A.G.) p 133–146 (See N69-21184 10-34)
10. THE IMPORTANCE OF INFORMATION FEEDBACK FOR PROJECT PLANNING AND DIRECTION S. Beck (Bolkow Entwicklungen K. G.) and H. Sewell (Boeing Co.) p 147–152 (See N69-21185 10-34)
11. INFORMATION FEEDBACK IN SPACE PROJECT MANAGEMENT R. W. Gutsch (Dornier-Werke G.m.b.H.) p 153–176 (See N69-21186 10-34)
12. THE USE OF CRITICAL PATH ANALYSIS METHODS IN THE EUROPEAN SPACE VEHICLE LAUNCHER DEVELOPMENT ORGANIZATION I. Stevenson (European Space Vehicle Launcher Develop. Organization) p 177–191 (See N69-21187 10-34)
13. PROJECT MANAGEMENT OF THE THIRD STAGE OF ELDO-A LAUNCH VEHICLE H. Hoffman (Entwicklungsring Nord) p 192–204 (See N69-21188 10-34)

N69-21177# Office of Science and Technology, Washington, D. C.
PROBLEMS OF NATIONAL POLICY RELATING TO SCIENCE AND TECHNOLOGY
N. E. Golovin *In* BMwF Symp. on Proj. Management Dec. 1968 p 15–20 (See N69-21176 10-34)
Avail: CFSTI

An outline is presented of basic U.S. government policy assumptions and major problems regarding: (1) planning of research and development; (2) liaison with science and technology; (3) awareness of new opportunities in science and technology; (4) support of basic academic science and of technical fields; (5) provision of risk capital to the private sector to develop complex and costly systems; (6) training of talented youth and growing manpower needs in science; and (7) means of methods for evaluating progress, in particular for making decisions to curtail or terminate efforts lacking success. K.W.

N69-21178# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
PROJECT MANAGEMENT: WHENCE AND WHITHER? [PROJEKT MANAGEMENT: WOHER UND WOHIN?]
H. H. Koelle *In* BMwF Symp. on Proj. Management Dec. 1968 p 21–32 (See N69-21176 10-34) In GERMAN; ENGLISH summary
Avail: CFSTI

The characteristic features, functions, applications, and the economics of project management are defined. Personal and professional qualifications of the project manager and his role are discussed. The origin, growth, and future requirements of project management are summarized, with stress on current and future developments in Germany and Europe. K.W.

N69-21179# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ASPECTS OF MODERN PROJECT MANAGEMENT [ASPEKTE MODERNEN SYSTEM MANAGEMENTS]
K. R. Schwenn *In* BMwF Symp. on Proj. Management Dec. 1968 p 33–46 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

The problems encountered and experiences gained by U.S. aerospace companies in establishing effective systems management are discussed. Some of the considerations for adapting systems management, systems engineering, and systems integration to specific large-scale and small-scale projects are explained. Special attention is given to the position and role of the systems manager. Transl. by K.W.

N69-21180# Dornier-Werke G.m.b.H., Munich (West Germany).
GUIDE LINES AND RECOMMENDATIONS FOR SYSTEM MANAGEMENT [RICHTLINIEN UND EMPFEHLUNGEN AN EIN SYSTEM MANAGEMENT]
Wolfgang Kiessling *In* BMwF Symp. on Proj. Management Dec. 1968 p 47–69 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

Principles, experiences, and recommendations are presented for systems management in industry. The responsibilities of the agency letting the contract for a project as well as those of the contractor and the subcontractors are defined. Initial steps for the management of a project are outlined, including preliminary project

studies, planning of development and costs, coordination, and control. Also discussed are information exchange, responsibilities of the systems manager, and organization of the management.
Transl. by K.W.

N69-21181# TRW Systems, Redondo Beach, Calif.
MANAGEMENT OF SATELLITE PROJECTS
A. B. Mickelwait and A. K. Thiel *In* BMwF Symp. on Proj. Management Dec. 1968 p 70–85 (See N69-21176 10-34)
Avail: CFSTI

Management principles and techniques derived from U.S. space programs are discussed with a view toward application in European space programs. The management examples typically concern a scientific satellite program with: (1) total spacecraft costs of $20 million to $60 million over two to three years; (2) an aerospace prime contractor with spacecraft systems responsibility; (3) newly developed hardware design of 25% or more; (4) involvement of such varied technical disciplines as structure, propulsion, communications, power, ground support equipment, and scientific experiments. Key management features for achieving the desired balance of schedule, costs, and technical performance are outlined. Control by the contract-letting agency, implementation by the contractor, responsibilities, work distribution, and overall control are discussed.
K.W.

N69-21182# Bolkow Entwicklungen K. G., Munich (West Germany).
PROJECT MANAGEMENT FOR THE FIRST GERMAN SATELLITE "AZUR" [DAS PROJEKT MANAGEMENT FUER DEN ERSTEN DEUTSCHEN SATELLITEN "AZUR"]
E. Theunissen *In* BMwF Symp. on Proj. Management Dec. 1968 p 86–99 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

A chronological account of the work is presented. The initial step was a feasibility study to consider the technological means and methods required to accomplish the task. A work breakdown structure was established for the satellite, the scientific experiments, the launch vehicle, and the ground stations. The technical characteristics of the satellite, milestones, and cost estimates were determined during the project definition phase. Special attention was paid to interface specifications. PERT plans facilitated overall control of the project. The control during development, production, and test phases is briefly described.
Transl. by K.W.

N69-21183# European Space Research and Technology Center, Noordwijk (Netherlands).
PROJECT MANAGEMENT OF EUROPEAN SATELLITES FROM THE POINT OF VIEW OF THE ORGANIZATION AWARDING THE CONTRACT [DAS PROJEKT MANAGEMENT EINES EUROPAEISCHEN SATELLITEN AUS DER SICHT DES AUFTRAGGEBERS]
Heinz Busch *In* BMwF Symp. on Proj. Management Dec. 1968 p 100–132 In GERMAN; ENGLISH summary (See N69-21176 10-34)
Avail: CFSTI

Based on scientific satellite project experience at ESRO and other European and non-European organizations, the project management problems are discussed from the point of view of the contract-awarding agency. Management prerequisite and the various phases of development, production, launching, and satellite operation are discussed. Management responsibilities, and guidance functions are stressed. An initial organigram assigns management functions according to technical specialities and forms a basis for determining size and organization of the project team. Cost estimates for satellites of different sizes are presented which take into account the manpower requirements and complexity of the equipment as well as testing, launching, and operation.
K.W.

N69-21184# Junkers Flugzeug- und Motorenwerke A. G., Munich (West Germany).
THE PROJECT MANAGEMENT OF HEOS-A AS AN EXAMPLE FOR THE DESIGN AND EXECUTION OF A EUROPEAN SATELLITE [DAS PROJEKT MANAGEMENT HEOS-A ALS BEISPIEL FUER DIE AUSLEGUNG UND DURCHFUEHRUNG EINES EUROPAEISCHEN SATELLITEN]
J. Henrici *In* BMwF Symp. on Proj. Management Dec. 1968 p 133–146 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

The coordination and management aspects of the bidding for the project by a combined group of four European firms and one American firm are briefly described. The American firm served as the adviser to the European firms. Engineering plans for systems breakdown, components, and specifications are explained. Simultaneous development of the cost matrix and milestones resulted in an overall PERT plan. The critical path method and strict interface definitions were employed. Due largely to the inexperience in coordinating an international work force, management costs with PERT plan and control office expenditures amounted to 8% of the total project costs. A detailed description of work progress control, personnel requirements, documentation, and organization is given.
Transl. by K.W.

N69-21185# Bolkow Entwicklungen K. G., Munich (West Germany).
THE IMPORTANCE OF INFORMATION FEEDBACK FOR PROJECT PLANNING AND DIRECTION [DIE BEDEUTUNG DER INFORMATIONSRUECKKOPPLUNG BEI DER PROJEKTPLANUNG UND -FUEHRUNG]
S. Beck and H. Sewell (Boeing Co., Seattle, Wash.) *In* BMwF Symp. on Proj. Management Dec. 1968 p 147–152 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

The responsibilities of the project manager and his use of the information flow for planning, directing, and controlling are outlined. The data flow in connection with task definition, systems specifications, work distribution, and cost control is demonstrated by means of simplified diagrams.
Transl. by K.W.

N69-21186# Dornier-Werke G.m.b.H., Munich (West Germany).
INFORMATION FEEDBACK IN SPACE PROJECT MANAGEMENT [DER INFORMATIONSREUCKFLUSS IM MANAGEMENT VON RAUMFAHRTPROJEKTEN]
Roland W. Gutsch *In* BMwF Symp. on Proj. Management Dec. 1968 p 153–176 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

A study of management control problems was conducted for aerospace projects on a European scale. The control function of systems management is considered in the form of input-output information, particularly in regard to quality and quantity of the required information. Input information controls technical task formulation or technical specifications, extent of efforts, priorities, deadlines, budgets, personnel, and reporting. Output information informs the systems management of the progress of a project and facilitates review, control, and coordination. The interplay of input and output during the various phases of a project is analyzed, and the organization of feedback data is discussed.
Transl. by K.W.

N69-21187# European Space Vehicle Launcher Development Organization, Paris (France). Central Planning and Progressing Service.
THE USE OF CRITICAL PATH ANALYSIS METHODS IN THE EUROPEAN SPACE VEHICLE LAUNCHER DEVELOPMENT ORGANIZATION

I. Stevenson *In* BMwF Symp. on Proj. Management Dec. 1968 p 177–191 (See N69-21176 10-34)
Avail: CFSTI

The critical path method was adapted by ELDO to provide a system that is: (1) effective for overall planning; (2) compatible with the systems used by the seven independent member states; (3) effective in informing all levels of project management; (4) a common routine for reporting progress; (5) understandable at all levels of management; and (6) easy to introduce. The method consists of network planning at three levels: the ELDO secretariat, the national, and the contractor levels. In this paper, the communication, progress reporting, reporting cycles, allocation of resources, cost control, the computer analyses, and special problems are summarized. K.W.

N69-21188# Entwicklungsring Nord, Bremen (West Germany).
PROJECT MANAGEMENT OF THE THIRD STAGE OF ELDO-A LAUNCH VEHICLE [DAS PROJEKT MANAGEMENT DER DRITTEN STUFE DES ELDO-A TRAEGERS]
H. Hoffman *In* BMwF Symp. on Proj. Management Dec. 1968 p 192–204 In GERMAN (See N69-21176 10-34)
Avail: CFSTI

The combined management by two German firms of this large-scale space industry project is described. The problems encountered during the development and integration of components are discussed. Centralization and coordination of project and systems management are emphasized because of their decisive influence on work progress. Transl. by K.W.

N69-21218# Road Research Lab., Crowthorne (England).
MEASUREMENTS OF SKIDDING RESISTANCE ON THREE GERMAN AUTOBAHNS, SEPTEMBER 1967
F. T. W. Lander and F. A. Jacobs 1968 20 p ref
(PB-182095; RRL-LR-170) Avail: CFSTI CSCL 13B

The report gives the results of measurements of skidding resistance obtained with a sideway-force test vehicle. These measurements were made between 25th and 27th September, 1967, on 41 sections of autobahns in Bavaria and in the Cologne area of Germany. Information is also given on the cost, design, traffic flows and texture-depths of surfacings. Author (USGRDR)

N69-21283# Federal Council for Science and Technology, Washington, D. C.
THE ROLE OF THE TECHNICAL REPORT IN SCIENTIFIC AND TECHNOLOGICAL COMMUNICATION
Dec. 1968 113 p refs
(PB-180944) Avail: CFSTI CSCL 05B

A study was made to appraise the role of the technical report in the scientific-engineering communication process in order to: (1) recommend methods of improving its quality and usefulness, (2) rationalize its interfaces with the other media for communication such as professional society and other technical journals, symposia proceedings, and books, (3) continue to satisfy and to enhance the Government-sponsor technical-agent contractual relationship. Author (USGRDR)

N69-21254# Southern Interstate Nuclear Board, Atlanta, Ga.
CONFERENCE ON SCIENCE, TECHNOLOGY AND STATE GOVERNMENT Background Study Report
Wyatt M. Rogers [1968] 57 p refs Meeting held at Louisville, Ky., 19–20 Sep. 1968 Sponsored in part by NSF
(PB-180923) Avail: CFSTI CSCL 05A

A number of states have recently established science and technology agencies within state government to deal with the problems and opportunities associated with scientific advances. Several such programs are described in some detail in this report. Author (USGRDR)

N69-21328# National Physical Lab., Teddington (England). Ship Div.
TRANSVERSE STABILITY OF ROUND-BOTTOMED HIGH SPEED CRAFT UNDERWAY
W. J. Marwood and D. Bailey Oct. 1968 13 p refs
(NPL-SHIP-98) Copyright. Avail: CFSTI

Three models of round-bottomed ship hull forms were studied and the height of the center of gravity above the bottom of the moulded keel line, the metacentric height and the angle of heel were determined for each of them under various conditions. As a result the limiting value of the metacentric height for transverse stability can be estimated for any form within the range of beam-draft ratio from 2.0–6.0 and speed-length ratios from 2.0–4.0. ESRO

N69-21420# European Space Research Organization, Paris (France).
THE RESOLUTIONS ADOPTED BY THE EUROPEAN SPACE CONFERENCE [RESOLUTIONS ADOPTEES PAR LA CONFERENCE SPATIALE EUROPEENNE]
In its ESRO/ELDO Bul. No. 4 Jan. 1969 p 8–13 (See N69-21419 10-31) In ENGLISH and in FRENCH
Avail: CFSTI

At the Ministerial Meeting of the European Space Conference held at Bad Godesberg on 12-14 November 1968, five Resolutions were adopted. These Resolutions are reproduced below, verbatim, except that for reasons of brevity, the introductory preamble to some of the Resolutions is omitted, and for ease in readability most of the references to Working Papers are also omitted. The voting positions adopted by the representatives at the Conference are indicated after each Resolution. (ESRO)

N69-21458# Technological Lab., RVO-TNO, Rijswijk (Netherlands).
METHOD FOR EVALUATING FRAGMENTATION. PART 2: FRAGMENTATION BALLISTICS-1 [MECHANISME EN EVALUERING VAN VERSCHERVING. DEEL 2: SCHERFBALLISTIEK-1]
A. A. J. Schellings Oct. 1968 47 p refs In DUTCH
(TL-1968-20; TDCK-52466-III) Avail: CFSTI

A method is presented for calculating the minimum effective mass of fragments resulting from the explosion of a shell. The method makes use of a simple velocity reduction formula based on recent findings regarding aerodynamic drag. The results calculated for four different target criteria are presented in graphical form. A method for estimating the effectiveness of uncontrolled fragmentation is also discussed. Transl. by K.W.

N69-21459# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
METHOD FOR EVALUATING FRAGMENTATION. PART 3: FRAGMENTATION BALLISTICS-2 [MECHANISME EN EVALUERING VAN VERSCHERVING. DEEL 3: SCHEREBALLISTIEK-2]
A. A. J. Schellings Nov. 1968 21 p refs In DUTCH
(TL-1968-22; TDCK-52468-III) Avail: CFSTI

Fragmentation ballistics and effectiveness of artillery shells for a combination of target criteria are discussed. The target criteria basically consist of the distance traveled by the fragment, penetration of an armor plate, distance traveled after penetration, and remaining energy of the fragment to cause injury or damage. A method is presented which calculates the correlation between initial velocity of the fragment and minimal effective fragment mass. Transl. by K.W.

N69-21461# Advisory Group for Aerospace Research and Development, Paris (France).
INDEX TO AGARD PUBLICATIONS, 1952–1963: SUPPLEMENT NUMBER FOUR, 1967
A. G. Vannucci, comp. and J. C. Dunne, comp. (Min. of Defence, London) 1967 138 p refs
(AGARD-Index-Suppl-4) Avail: CFSTI

The general arrangement of material within this supplement follows that of earlier supplements. The subject and author indexes relate only to the material listed in this supplement, whereas the report and document number index provides a complete listing of all AGARD documents entered in the AGARD Publications Index 1962–1963 and in the subsequently issued supplements. An index of NASA and AD accession numbers of the more recent AGARD publications is also included. Author

N69-21662# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 5, NUMBER 3 Monthly Review of Selected Foreign Scientific and Technical Literature
Mar. 1969 103 p refs
Avail: CFSTI

CONTENTS:

1. THE BIOLOGICAL ROLE OF NITROGEN AND SPACECRAFT CABIN ATMOSPHERES B. Mandrovsky p 1–17 refs (See N69-21663 10-05)

2. ELECTROLYTIC THEORY OF PHOTOSYNTHESIS B. Nartsissov p 18–24 refs (See N69-21664 10-04)

3. THE SOYUZ 4/SOYUZ 5 JOINT SPACE MISSION D. Wood p 25-44 refs (See N69-21665 10-31)

4. RECENT SOVIET RESEARCH ON INORGANIC NITROGEN FLUORIDES S. Markov p 45–55 refs (See N69-21666 10-06)

5. NEW ELECTRO-OPTICAL DEVICES I. Velinov p 56–64 refs (See N69-21667 10-08)

6. THE FIFTIETH ANNIVERSARY OF THE "ORDER OF THE RED BANNER OF LABOR" PHYSICOCHEMICAL SCIENTIFIC RESEARCH INSTITUTE IM. L. Ya. Karpov p 65–68 refs

7. THE THIRD ALL-UNION SYMPOSIUM ON THE SEISMIC REGIME p 69–74 refs

8. CONFERENCE ON THERMAL STRESSES IN STRUCTURAL MEMBERS p 75–78 ref

9. CONFERENCE ON DISPERSION-STRENGTHENED AND FIBER-REINFORCED MATERIALS p 79–82 ref

10. SYMPOSIUM ON THE RHEOLOGY OF POLYMERS p 82–85 ref

11. PERSONALITIES p 86–90 ref

12. THEORY OF APPROXIMATE METHODS AND THEIR APPLICATION TO THE NUMERICAL SOLUTION OF SINGULAR INTEGRAL EQUATIONS V. V. Ivanov p 91–94

13. BIOCATALYSTS AND THEIR MODELS L. A. Nikolayev p 94–95

N69-21723# Applied Science Associates, Inc., Valencia, Pa.
AN EXPERIMENTAL COMPARISON OF PROCEDURAL AND CONVENTIONAL ELECTRONIC TROUBLESHOOTING Final Report, May 1967–Aug. 1968
Thomas K. Elliott and Reid P. Joyce Wright-Patterson AFB, Ohio AFSC, Human Resources Lab. Nov. 1968 131 p refs
(Contract F33615-67-C-1776)
(AD-681510; ASA-1776-68-1; AFHRL-TR-68-1) Avail: CFSTI CSCL 5/9

Two groups of subjects solved the same set of 13 troubleshooting and repair problems in seven solid-state circuit modules which contained up to five stages each. Both groups used the same hand tools and test equipment. One group was composed of 41 Air Force 5- and 7- level technicians who normally maintain such equipment as part of their jobs. The technicians used the same troubleshooting techniques they ordinarily used on their jobs, and they were provided with a conventional technical orderlike performance aid to support the task. The other group was composed of 20 high school students with no prior training or experience in electronics. Their training for this study consisted of a special 12-hour course (compared to several months for the technicians) and they used a specially developed performance aid which told them which check to make, based on the outcome of previous checks. In terms of the speed with which they worked or the frequency with which they were able to effect repairs on the modules, there were no substantial differences between the two groups. But the difference in training time and, therefore, cost of training between the two groups is so great as to suggest the possibility that job-relevant training and proceduralization of the task can introduce substantial savings, even after the cost of developing the special performance aids required by proceduralized troubleshooting is subtracted. The findings of the series of six studies of which this study was one are also summarized. Author (TAB)

N69-21913# RAND Corp., Santa Monica, Calif.
MEASUREMENT OF TECHNICAL PERFORMANCE IN WEAPON SYSTEM DEVELOPMENT PROGRAMS: A SUBJECTIVE PROBABILITY APPROACH
S. F. Timson Dec. 1968 70 p refs
(Contract DAHC15-67-C-0141; ARPA Order-189-1)
(AD-681771; RM-5207-ARPA) Avail: CFSTI CSCL 15/3

The report describes a procedure for measuring the status and progress of a complex system development program. The procedure is based on four premises: (1) Progress is characterized by reduction of uncertainty; hence, if uncertainty can be measured at different times, progress can be indicated by changes in measures of uncertainty. (2) Assessment of uncertainty relative to development is subjective. (3) Subjective estimates of uncertainty can be expressed in terms of probabilities. (4) The amount of uncertainty is indicated by statistical measures of appropriate probability distributions. Consistent with these premises, the procedure for obtaining probability distributions for critical system performance characteristics involves five steps: (1) Obtain design equations. (2) Determine subjective probabilities. (3) Generate probability distributions for system performance. (4) Calculate statistical measures. (5) Compare measures at different times to obtain indications of progress. Methods for determining subjective probabilities should be tested in a real-world development program. Author (TAB)

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